PRODUCTS finishing

FRED W. VOGEL, Editor

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WHEN a worker's health is impaired through lack of proper precautionary measures, the worker's earning capacity is reduced, production is curtailed, and disruption to the general routine of a business follows. Conditions of this type are in many cases avoidable. With the proper knowledge of the hazard at his command a worker can and usually will find a satisfactory solution to his problem.

In this issue there appears an introduction to a general discussion of the health hazards encountered in the metal finishing department. This article is written by Mr. N. E. Promisel and is published under the heading "Health Hazards in the Finishing of Metals."

It is our firm belief that once the hazard is known, a more intelligent and more aggressive effort can be made to eliminate the hazard. The results may take the form of investment in additional equipment, while in other cases only the further application of available materials and equipment will be required.

The suggestions offered by Mr. Promisel are made in the interest of the men in the shop; the workmen whose livelihood depends upon their ability to stay on their jobs all the time. The information to be presented in this series should be especially valuable to metal finishing department executives who are interested in making the working conditions under their jurisdiction safer and more healthful.

After all is said and done on the matter of health hazards, everyone will agree that an ounce of prevention is still worth a pound of cure.

FINISHING WI
BOARD AR

By GEORGE [illegible]ONROE, JR

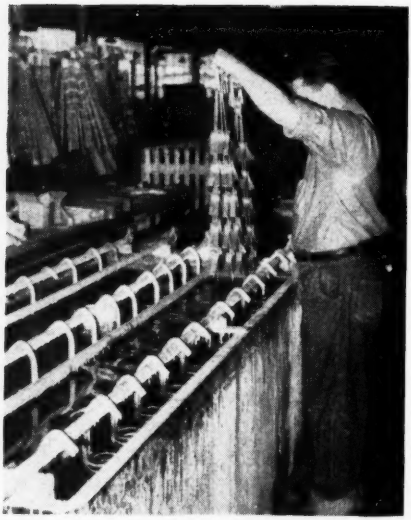
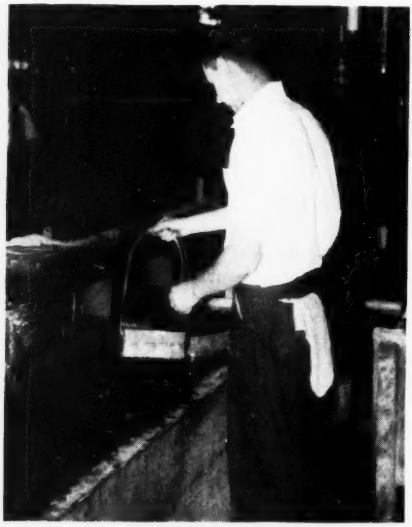


Fig. 1—Illustration showing an operator removing a rack of swivel plates for relay throw arms from the bright zinc plating tank. Zinc and cadmium plating prevents corrosion of parts exposed to the outside elements.

Fig. 2—Cleaning brass screws, lugs, and brass strips before sending them to the storeroom.



HEADING the list of all intricate mechanisms that have been devised to facilitate today's business is the modern telephone switchboard. Popularly known as a PBX switchboard, a derivation from Private Branch Exchange, this instrument of the modern office, with its thousands of parts assembled in a box no larger than half the size of an average telephone booth, operates with uncanny accuracy and efficiency. The Kellogg Switchboard & Supply Company, Chicago, Ill., manufactures the PBX switchboard.

The PBX switchboard is a veritable box of magic composed of thousands of small parts, some metal, some wood, and some plastics. Nearly every one of these parts requires plating and involves not one standardized type of plating but nearly a dozen different highly-specialized plating problems. For example, consider the smallest part of a completed PBX assembly—the transmitter breastplate set which hangs on a strap around the operator's neck. This part is considered simple. It contains only 30 parts to be finished—30 plating problems in a unit weighing less than 10 oz. when completely assembled. In addition to normal problems of selecting the type of finish, there is added

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GEORGE DONROE, JR.

the problem of selecting a finish that will be a sufficient conductor of electricity for the purpose. This means plating with gold, nickel, cadmium, copper, chrome, or zinc as the need demands.

These were some of the problems facing the Kellogg Company in fitting the plating department into their new million-dollar plant, completed less than a year ago. Satisfactory solutions to these problems were finally found by making the plating and finishing department, like the company's product, a built-to-order job.

Location and arrangement was the first consideration. The entire plant, a block wide by two blocks long, was set up for the most economical straight-line production. Manufacturing of parts and materials progressed from rough to fine up the length of the left side. The assembly line runs down the right side, ending in the cabinet shop beside the loading platforms of a spur track which passes through the rear of the plant. Between these two sides, that is, down the center of the plant, is located an immense storage department. Raw materials are stored on the left, facing the particular manufacturing department that will use them first.

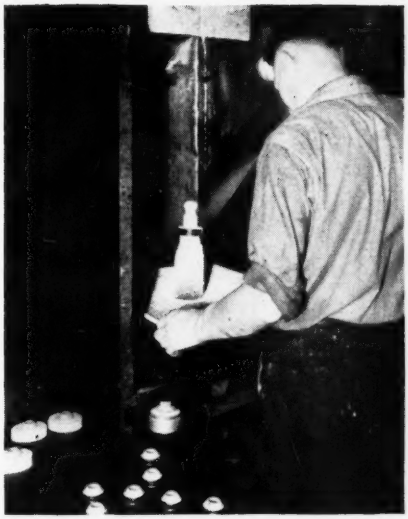
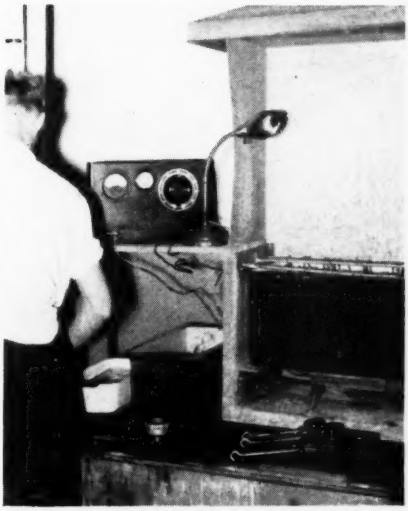
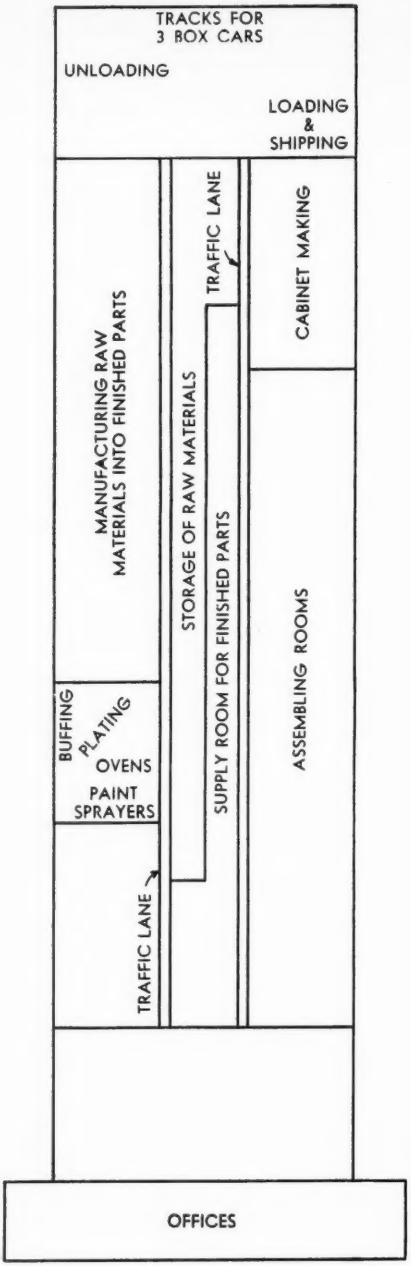


Fig. 3—Spraying white paint on metal housings for operator's breastplate transmitters. Lower left—housings sprayed, ready for bake ovens. To the right are some housings waiting to be sprayed.

Fig. 4—Gold plating transmitter diaphragm at point of carbon contact. Each of the three "forms" just below the tank contain one diaphragm.





Finished parts line the right, facing their rightful places in the assembly line.

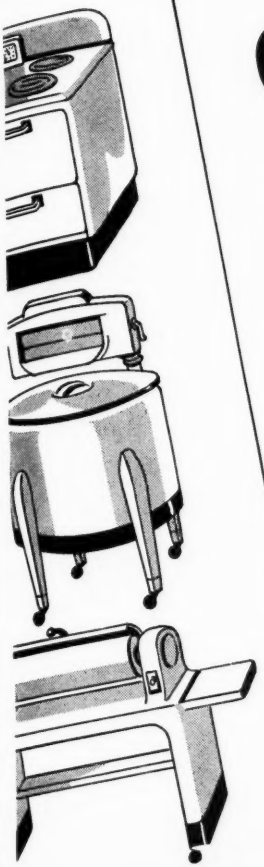
With such a layout, it was easy to fit the finishing room into its proper place at the end of the manufacturing line. Here, in a space only 50 by 75 ft., is done all of the plating, buffing, cleaning, spraying, and baking for the entire plant, except for spray painting of the heavy metal assembly frames. From this important point, finished parts go either across the aisle into stockroom inventory or around the center stockroom directly into the assembly line.

Along the right side of the finishing department are three paint spray booths and behind them the ovens for enamel baking and crackle finishing. Along the left side is arranged the gold plating equipment followed by the buffing and polishing machinery. In a rough semicircle between these two lines, the remainder of the plating equipment has been positioned.

This plating layout consists of 20 tanks, ranging from eight-foot zinc baths down to an 18-in. silver bath. In spite of the large number and variety of parts handled, the bulk of the plating and cleaning volume consists of brass screws, lugs, contact strips, and so on. These parts are handled in bulk by rigging four perforated casks, one foot in diameter by three feet deep, which can be loaded with small parts and lowered by overhead crane into the desired tank. Brass screws are nickel plated; most of the balance of the pieces requiring only cleaning.

Beside the bulk layout are tanks for cadium plating those parts re-

Fig. 5—Drawing showing the general floor plan of the Kellogg Switchboard plant.



Case History

Here is an interesting story—a story of big savings and big results under difficult metal-cleaning conditions.

A company cleaned a wide variety of jobbing parts which came from several sources and were fabricated with different drawing compounds.

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Fig. 6 — Buffing and coloring nickel-plated swivel housing for Kellogg operator's breastplate transmitter. The large diameter wheel on the left is used for straight buffing and the small wheel on the right for coloring.

quiring protection from the elements and subject to excessive wear. Next come facilities for tinning heavy copper wire and chrome-plating parts where smoothness and appearance are important factors.

Thus a great many of the 50,000 and more finished parts are handled as routine speed operations. The headaches and the trickiness came in designing custom equipment for handling the odd and unusual jobs.

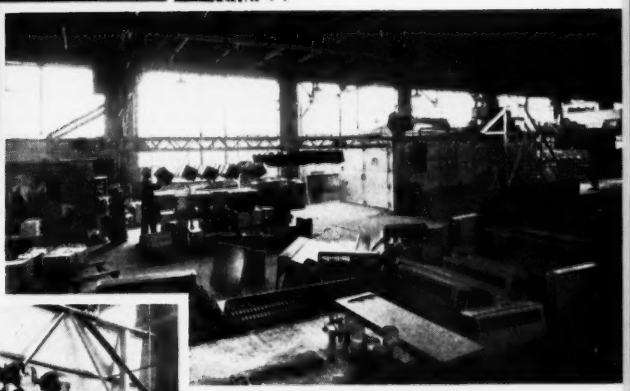
In the breastplate transmitter, one of the vital parts is a thin circular diaphragm of special alloy. The diaphragm is flat except for a tiny tip, a quarter-inch high, in the exact center. Because this tip must extend down into a bed of carbon granules and make perfect electrical contact, it has to be gold-plated, both for conductivity and protection against corrosion.

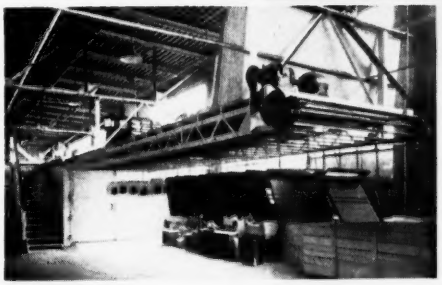
To gold plate this tiny tip without wasting costly gold on the surrounding metal, composition moulds or forms were designed. Each form holds one diaphragm, allowing only the tip to project through a $\frac{3}{16}$-in. hole. A number of these forms may be suspended in the tank at a time with perfect assurance that the gold goes only where it is meant to go.

While this is being done, the magnet activating this diaphragm is cadmium plated to resist moisture. The breastplate itself, a thin aluminum sheet, 4 by $5\frac{7}{8}$ in., is across the room, being sprayed both sides with black enamel before baking in the adjoining ovens. On the transmitter housing, the ball on which the transmitter socket fits is nickel plated for smooth

Fig. 7—Illustration showing assembly operation of plated parts in a switchboard frame.

NEW DESPATCH INTERMITTENT OVEN SOLVES FINISH BAKING PROBLEM for McQUAY, INC.





McQUAY, Inc., manufacturers of steam unit heaters and air conditioning units had a finish baking problem common in the industry. Production was too large and unsuited to using batch type ovens. Space facilities did not accommodate a continuous conveyor oven. Despatch Engineers worked out McQuay's problem with an intermittent type of oven. The conveyor permits the work to intermittently progress from the spraying booth right through the oven to the unloader. Loading, baking and unloading simultaneously greatly increases production and at the same time conserves floor space. The finishes are perfect and material handling and fuel saving are reported. Just as the Despatch engineering principles solved the McQuay problem, they can be relied upon to help solve your finish baking oven problem. The new Despatch Bulletin No. 51 outlines many principles of modern finish Baking and Drying Ovens. Write for copy today.

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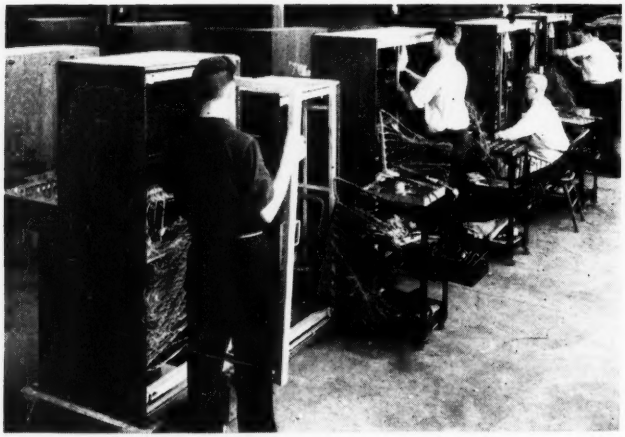

Fig. 8—Plated metal parts have been assembled in the paint-sprayed frames and encased in wooden cabinets. Note the wires attached to the appropriate metal parts.

operation. When finished, the nickel must be masked while the balance of the housing is sprayed with white paint and then baked. Meanwhile, the swivel housing for the ball is being nickel plated, buffed, and colored on a wheel.

From these, only a few of the hundreds of vitally important finishing operations required on every Kellogg PBX Switchboard, it may be seen what a complicated problem faced the designers of this department.

It is easy to see, too, that such a variety of operations might easily create a bottle-neck during rush jobs. To guard against such an emergency, the department utilizes all spare time and slack periods in turning out all standard parts. The standard parts after being finished are transferred to the stock room to be used in feeding the assembly line. Thus, during busy periods, the bulk of the finishing department's time is concentrated on just those particularly tricky or specially-designed parts needed for the jobs at hand.

With this straightline production layout, specially built finishing equipment for special jobs and practice of maintaining a constant inventory of stock parts, the Kellogg Company has been able to operate its finishing department at consistent top production without jamming, regardless of plant demands.

Coffing Products Catalog No. G-3. In this 24-page catalog, the complete line of products marketed by the Coffing Hoist Co., Danville, Ill., is presented by means of descriptions and photographs. Products covered include spur gear chain hoists, utility maintenance tools, differential chain hoists, trolleys, ratchet lever hoists, spur gear gravity hoists, electric hoists, and load binders. Also included are numerous application photographs of the various pieces of Coffing equipment. Copy of Catalog No. G-3 free upon request.

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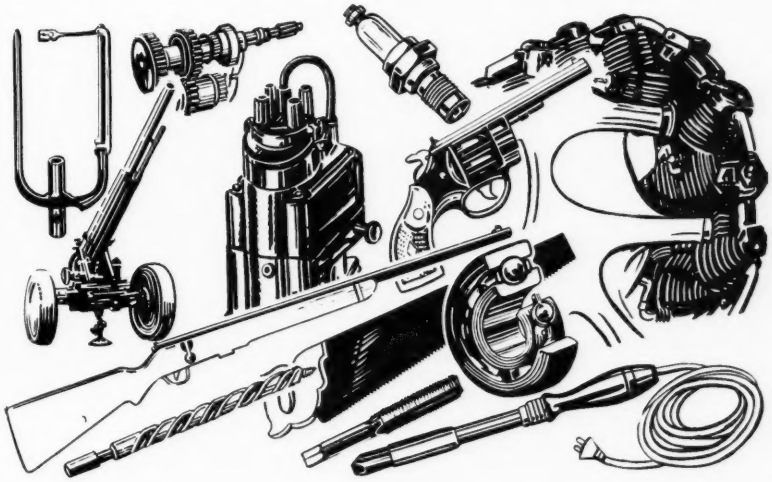

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HEALTH HAZARDS IN THE FINISHING OF METALS

PART I--Introductory and Miscellaneous

By N. E. Promisel
Industrial Consultant, Brookline, Massachusetts

IT has been said that the intelligence of a race may be measured by its industry and that the primary raison d'etre—the primary purpose—of industry is safety and health. If this is so, such industrial fields as pickling, polishing and plating in the past have not spoken too highly for our intelligence and have helped give rise to the rather ironical fact that so many of these industrial establishments have been a constant danger to the well-being of the workers who were in the very act of producing the means for the well-being and comfort of others.

Admittedly, this statement is truer of past conditions than of present ones, for there is a growing realization and appreciation of the practical, not to mention humanitarian, benefits to be derived from sanitary, safe and healthful working conditions, not only from the point of view of fewer interruptions in production due to illness and fewer compensatory expenses, but also from the point of view of increased contentment and comfort while working and of resulting increased efficiency.

For example, recently a small shop, employing only 115 men, by proper attention to details of health preservation, effected in one year a savings of $3,240 in reduced absenteeism and reduced turnover by 25 per cent. In this respect we may, on the one hand, console ourselves with the thought that, after all, industrial deaths (in 1935) were less than half of automobile deaths, 16,500 against 36,400. On the other hand, however, this is little consolation when we learn that an estimated 98 per cent of these deaths were due to preventable causes, such as supervisory defects in instruction, poor discipline, unsafe practices, poor choice of employees, physical hazards, defective equipment, improper building or working conditions, and so on.

However, while distinct progress is being made in the amelioration of health hazards of the past, the unceasing, ever-expanding technological developments create with their new processes and products and with their increased tempo of operations new dangers to the industrial worker. Some of them are known and can be safeguarded against; some of them are known but can be made only less hazardous; and some of them unfortunately are not known until they have taken some toll of human health. In all cases, however, some precautions can be taken, neglect of which is truly criminal, and the steadily

declining percentages of sufferers from industrial afflictions is testimony of the perseverance and success of the workers in this important field.

It was thought that this series of articles on health hazards might be especially appropriate at this period of increased industrial activity, when no doubt there will be a greater tendency for carelessness and neglect in industrial operation and when, at the same time, the worker will often be more susceptible to injury because of his own condition resulting from increased or even excess activity. It is not planned to deal with the more obvious sources of accidents, such as mechanical and physical causes or utter carelessness on the part of the worker, nor is it planned to deal, except partly in this article, with general considerations for good health, such as periodic medical examination, sanitation, and so on, which have been so well treated elsewhere. Instead, the treatment will be more specific, will have to do mainly with disease as opposed to accidents and subsequently will deal with hazards more chemical in nature. The present article will describe a variety of factors contributing to health impairment leaving for future discussion three major subjects: (1) poisons, including solvents, fumes, metals, plating solutions and general chemicals, (2) skin effects, and (3) dusts.

There are many factors and agents affecting the health of the industrial worker. These may be divided into two groups, subjective and objective. The subjective factors, concerning the individual himself, may be listed, without regard to relative importance, as follows:

1. Race.
2. Sex.
3. Age.
4. Living habits.
5. Personal characteristics.
6. Experience and familiarity with particular operation.
7. Susceptibility to particular hazard.

Let us enlarge briefly on these items. It is well-known that particular races are better suited to certain operations than others. The Japanese, for example, would be much better adapted to, and therefore less subject to injury from, spray-gun work than the handling of heavy work in a plating room. The Negro skin is much more resistant to chemical action than white skin. Blondes, on the other hand, are more sensitive to skin irritants than brunettes, and, gener-

TABLE I

Activity	Volume of air breathed, cu. ft. per hr.	Energy expended, calories per hr.	Oxygen cu. ft. per hr. consumed,
Rest in bed, fasting	12.7	69.0	0.51
Sitting	14.8	86.4	0.64
Standing	17.0	103.2	0.76
Walking 2 miles per hr.	29.7	187.2	1.38
Walking 4 miles per hr.	55.2	345.6	2.54
Slow run	91.2	576.0	4.24
Maximum exertion	138 to 212	840 to over 1,200	6.36 to 8.48

This table is based on data in "Noxious Gases," by Henderson, Yandell and Haggard.

ally speaking, therefore are not as preferable, for example, in cadmium plating installations. Again, the last war showed that Negroes were less susceptible to mustard gas, although on the other hand, they are more subject to lead poisoning.

Women, as a rule, are younger in industry than men, and of course are not as strong. Aside from physical strength, the sexes vary in their susceptibility to certain poisons. For example, women are more sensitive to lead and to benzene. The possibility of chemical effect on some female organs also should not be overlooked, such as the abortifacient action of certain poisons.

In many respects, youth is more sensitive chemically than older persons. At the same time, the greater alertness, greater capacity for recovery, usually better physical condition, all tend to increase his resistance to industrial hazards.

The living habits of the worker are of course very important. The industrial class as a whole has its own particular habits. From its very nature, such influences as continuous labor and continued exposure to health hazards increase his susceptibility to injury. His hours of rest at home, both physically and mentally, do much to affect both his actions at work and his sensitivity and, in the case of poisons especially, the type and amount of food which he consumes may also have specific effects. For example, alcohol intake increases the effect of chlorinated hydrocarbons such as trichlorethylene and milk decreases susceptibility to lead poisoning.

In a sense living habits are closely related to personal characteristics. An individual's personal traits determine, for example, whether he is given to excess alcoholism, to regular sleeping hours, and so on, all of which are very pertinent to industrial hazards. The physical condition of the individual may also be included here. Obviously, a person suffering from impairment of the lungs should not be exposed to polishing dusts containing silica. In addition, there is the consideration of such properties as inherent carefulness, cleverness, ability to understand the danger, to act quickly and similar qualities. The latter leads us also to the question of experience and familiarity with a particular operation, where obviously the novice is at a disadvantage.

Finally, we have listed individual susceptibility. In the case of poisons, many people have idiosyncrasies, for example, special susceptibilities to certain chemicals to which others may be immune. Today, more than ever before, the world is allergy-minded and there seems to be, in the extreme, hardly a substance to which someone is not unhappily sensitive, from textiles which may give some individuals a marked case of hives to dusts which bring tears to the eyes of others and serious nose discomfiture. It is often a worthwhile idea, in fact, to test individuals for their susceptibility to the materials to which they eventually will be repeatedly exposed. For example, a small pad soaked in a nickel solution and strapped to a worker's arm will reveal in a short time if he is particularly sensitive to this chemical combination.

So much for the subjective factors in industrial health. From the objective point of view, dealing with the types of hazards existing in the industries in which we are particularly interested, we may list the following:

1. Temperature, humidity and ventilation.
2. Dampness.
3. Radiation, illumination.

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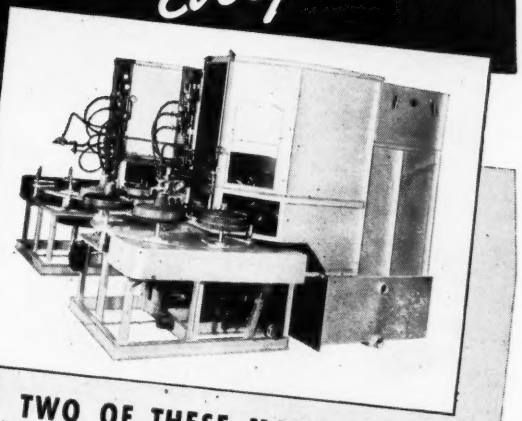

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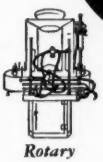

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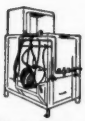
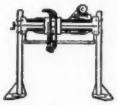


Pipe Coating



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9. Dusts.

1. Temperature, Humidity and Ventilation.

Changes in temperature affect the individual either indirectly through the disturbance of blood flow or directly. Cold constricts the blood vessels of the skin thereby diminishing the blood supply through the cutaneous circulation system. Heat increases the blood flow. Sudden changes, especially from hot to cold, as in drafts, not only cause bodily discomfort but contribute to neuralgia and respiratory diseases. Extreme heat results in heat exhaustion or heat stroke and extreme cold leads to frost-bite or gangrene and death. The latter is seldom met with in industry.

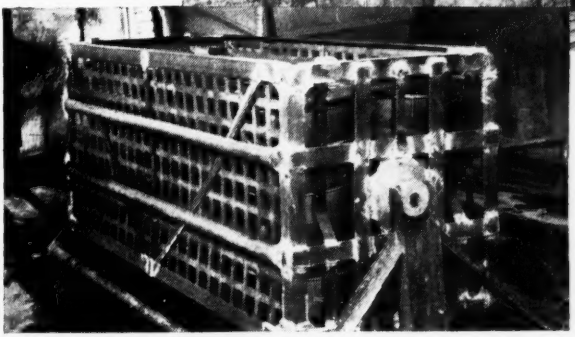
On the humidity side, too low a humidity dries up the mucous membranes of the nose, throat and lungs, thus lowering their resistance to infection, and too high a humidity interferes wtih the normal evaporation of moisture from the skin.

The U. S. Department of Labor divides hazards of this kind into three groups, dealing with (1) extreme dry heat; (2) heat and humidity; and (3) sudden variations in temperature. Extreme dry heat may occur in foundries, steel mills, vitreous enameling rooms, metal hardening or annealing rooms, smelting or refining rooms, near welding, near solvent stills, in some chemical plants, and so on. The individual is subject to an increase in pulse rate, increase in "blood pressure" and increase in body temperature, to excessive perspiration and finally to heat stroke. The entire body may suffer and evidence of this condition may be seen in skin eruptions and in disease of the eye such as conjunctivitis, retinitis and cataracts.

As for the severe condition of heat and humidity this is experienced less in the metal industry than in the paper and textile industries. The resultant effects are very similar to those described above except for the reactions of the eyes, which do not occur. Sudden variations of temperature can occur in all of the above places and in many other cases as well. They may lead or contribute to congestion of internal organs, various catarrhs, neuralgia, rheumatism, pneumonia and Bright's disease. Naturally, the preventatives in all the above cases are obvious. When cold, the worker should keep active, and when hot should allow his body to cool gradually. In the latter case, his diet should include plenty of water. Workers repeatedly exposed to high temperatures should increase their salt intake and for this purpose handy salt pill dispensaries are available. Mechanical aids such as proper clothing or various degrees of air conditioning are, of course, most beneficial.

Proper ventilation is intimately related to the above, in that frequent changes of air do much toward restoring the atmospheric conditions to normal. At the same time, even when temperature and humidity are satisfactory, and even when there is no question of removing or diluting particularly noxious fumes from the air by infiltration of fresh air, there is always the matter of normal individual resipiration involving a desired minimum rate of intake of oxygen and the release of a certain amount of carbon dioxide, which tends to become suffocating if allowed to accumulate. Where groups of individuals

Handles a ½ Ton Payload



One of ten welded Monel pickling baskets at plant of National Enameling & Stamping Company, Granite City, Ill.

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work in close proximity in rather confined spaces containing no exhaust or ventilating systems, this is important. Table I gives an approximate comparison of the volume of air breathed in, the energy used and the oxygen actually consumed in various everyday activities.

To prevent carbon dioxide from exceeding a certain limit, in the neighborhood of 6 volumes in 10,000 volumes of air, the average adult requires an atmosphere of 3,000 cu. ft. of fresh air per hour. It is estimated that in winter, the average number of changes of air, not referring to specially treated air, permissible without causing disturbing drafts is 3 changes per hour. Under such conditions, the available working space per person should be therefore theorectically about 1,000 cu. ft.

2. Dampness

While some of the conditions already described also come under this heading, there are many cases where atmospheric conditions are normal but where wet conditions exist just the same as in the vicinity of plating, pickling, vitreous enameling, wet grinding, and so on. Continued exposure to such conditions may lead to diseases of the respiratory passages or to neuralgia and rheumatism. Great improvement results from the generous use in such vicinities of drains, duck boards, and rubberized clothing like aprons, rubbers, and long gloves.

3. Radiation, Illumination

The need for proper illumination, to prevent eye injury, to increase operating efficiency, to prevent accidents and to reduce unsatisfactory workmanship, is well realized. It is not always so well realized, however, that "proper illumination" involves consideration of not only light but also of glare and distribution and of color or wavelength. The amount of light needed is determined by the particular process. An engraver will require more light than a polisher, for example. The finest detailed industrial work generally requires about 100 foot-candles, a condition which can be readily measured on foot-candle-meters now on the market. For ordinary work, 20 to 50 foot-candles suffice. Below 10 foot-candles, deleterious effects on work and worker are likely.

Excessive glare, besides affecting actual visibility, also leads to fatigue. The use of indirect lighting, reflectors, diffusers and opalescent glass eliminates such dangers. In some cases, as in the inspection of metal surfaces, the light must be properly distributed or proper inspection is well-nigh impossible.

Although daylight is, of course, the best color for general purposes, many artificial lights are now excellent and of proper color. The color of light is dependent upon the wavelength of the light present. The invisible lights, which are lights of wavelengths to which the human eye cannot respond, are the most dangerous. Thus ultra-violet and infra-red light, produced in welding, torch cutting of metals, arcs, high temperature furnaces, brazing, certain lamps, and so on, are the most common hazardous radiations. Ultra-violet light causes temporary blindness (that is, snow blindness), irritation of the eyes and burns of the skin. Infra-red rays are heat-rays and give the familiar reactions of heat. A fairly recent application of the latter is the use of infra-red lamp-banks for accelerated drying of synthetic enamels.

Beyond the range of ultra-violet light come x-rays and the radiation from radium and other radio-active

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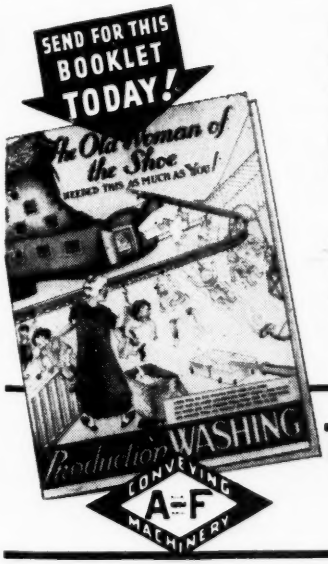

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substances. The former are becoming common for the non-destructive examination of products for internal flaws and the latter have often found their way into luminous paints. The danger of repeated exposure to such radiation cannot be over-emphasized since the results may be, and have been, serious burns, skin diseases, cancer, sterility and death.

4. Electricity

The dangers inherent in the handling of electricity are too well known to require elaboration. The real danger lies in carelessness and sudden contact with an unexpected source of high tension. For example, while plating rooms generally use low voltage sources, the increasing use of very high current densities, certain anodic treatments of light metals, increasing use of elaborate automatic machinery, heating units, and so on, brings definite hazards into the plating rooms, with their wet floors connecting the operators to ground. A similar situation exists in polishing rooms with their newly-acquired heavy automatic machinery.

The hazard from electricity is one against which complete protection may be readily realized and there should really be no need of considering it as an industrial health hazard. The rules to this end are not many: use warning signs near high power, leave no live wires exposed, work on live wires instead of dead ones only when necessary, carefully insulate the worker in the vicinity of high tension live wires by the use of heavy rubber gloves, rubber soles and heels or rubber mats, and use only experienced electricians for repair work.

5. Noises and Vibrations

This factor has largely been neglected in the past as a contributor to the impairment of health, and yet excessive noise may lead to functional deafness and to derangements of the nervous system, besides increasing fatigue and discomfort. While much can be done and has been done in minimizing noise at its source, the architectural features of a plant, its non-noise-producing furnishings, and even such factors as the paint on the walls have an important bearing on the level of noise created. When noise, that is, a sequence of sound waves, strikes a surface such as a wall or ceiling, part is transmitted, part is absorbed and part is reflected. If the reflected sound waves, or sounds transmitted into the room from an outside source, continue to be reflected from other surfaces in the room, the result is reverberations of a most disquieting nature. Even without actual reverberation, that is, without persistence of sound, echoes are possible which are also bad. Non-reflecting objects and materials in the room greatly improve this situation.

Many building materials are now available which are high absorbers and low reflectors of sound. In general these are light and porous like rough plaster, fiber board or rough porous tile, all of which may absorb 90 per cent of the incident noise. The dense, rigid materials like stone and steel may reflect as much as 99 per cent of the sound. By the same token, if a porous surface is destroyed as by covering or painting with a dense coating or an oil "sealer," its absorbent qualities are greatly diminished. Generally speaking, a little consideration of this factor, both in old and especially in new buildings, can very economically minimize what at best is a serious annoyance.

6. Neuroses

A neurosis is a nervous disorder and industrially may be of two types.

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One is a subconscious, psychological affair by which a worker, once injured but apparently cured, continues to complain of disability although there is no actual evidence of such disability. This feeling and tendency to drag out an illness, sincere enough on the part of the worker, may be related to an unconscious desire for continued compensation, to fear of returning to the scene and source of his injury, to an unconscious reluctance to return to work that for some reason or other was unpleasant, and so on. The other type of neurosis and the one with which we are more concerned is an occupational neurosis which is a condition of muscular strain or cramp due to repeated motion, pressure, or shock and characterized by pain of the muscle used, weakness or partial paralysis, tremors and similar afflictions. A familiar and homely example is writer's cramp.

In general, long-continued usage of certain muscles for a particular task results in these muscles not performing that particular task although their other functions are not impaired. This holds true not only for workers in such extremely applicable fields as pneumatic tool operation but also, of course, to a less degree, wherever tools are tightly grasped as in polishing, painting, engraving, burnishing, and so on. The possible remedies are not many. If continued pressure or shock is the cause, cushions or pads usually help. For continued tenseness and strain, occasional and timely rest periods are advisable.

7, 8, 9. Poisons, Skin Effects and Dusts

These subjects are more important and generally less understood than the miscellaneous ones discussed above. They will, therefore, be discussed in detail and at some length in separate future installments.

Magnus Cement Cleaner. The Magnus Chemical Company, Inc., 10 South Ave., Garwood, N. J., is now issuing a new descriptive illustrated folder on its product, Magnus Cement Cleaner.

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The new folder completely describes the product and shows applications of it in industrial plants, airport hangars, garages, and service stations. Copy free upon request.

Time Switches. A bulletin describing Type TSA-14 Time Switches for control of A.C. circuits is now being issued by the General Electric Company, Schenectady, N. Y. The Time Switches Type TSA-14 are designed for the automatic control of exhaust fans, pumps, blowers, filter cleaning, and so on.

According to the bulletin, this General Electric instrument is widely adaptable to repeating-cycle processes. Copy of this bulletin will be sent free upon request.

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BARREL FINISHING OF

Factors to be Considered In Unloading Burnishing Barrels

By H. LEROY BEAVER
Lansdale, Pennsylvania

WE come now in this series to one of its most important factors, that is, the proper and accepted methods for unloading and re-loading various types of burnishing barrels.

Apparently this factor is deemed of so little importance by the average barrel manufacturer, that thus far we have been unable, even though we have made diligent search through all available literature, to find any effort toward the supplying of suitable instrumentalities for performing this most important part of the barrel finishing procedure. Even a superficial study of this phase shows that in this operation lies the greatest factor of burnishing material loss, and the reason why most barrel users are periodically required to order lot after lot of materials to replace those lost in the carrying out of the process.

On the subject of loading and unloading devices, one of our more important barrel manufacturers says, and we quote from his literature:

> "We do not supply these boxes with the barrels, as we have found that they can usually be made on the premises or by some local tinsmith cheaper"

and another says, and we also quote:

> "Now in regard to loading and unloading we have gone over this problem a good many times and our engineers have started to sketch out some automatic means of doing this, but we have never been able to arrive at anything that we would consider satisfactory."

and on this subject, other barrel manufacturers are strangely silent. It would seem that in view of the importance of this factor that down through the past thirty years in which barrel finishing has seen its greatest development someone would have discovered some simple method for performing the work in what we might term the minimum time and with the least loss of burnishing material.

Only a short time ago one of our research clients writing to us on this same phase said:

> "In our plant we cannot but consider barrel finishing than as a sloppy and wet but withal a necessary evil. Cannot something be done to change all this?"

The answer to such a query, of course, is that if one wishes to oper-

NG OF METAL PRODUCTS

ate his barrel finishing department as though it were a cross section of an aquarium, the fault for such operation lies with the operator because such conditions are not in any sense necessary. But strange it is that this opinion seems to prevail not only in this country but abroad as well. In this connection we also quote from a paper read before the Midlands Centre of The Electrodepositors Technical Society, Birmingham, England, February 7, 1939, as follows:

"The position of the barreling shop as a MONEY SAVING unit of production is seldom appreciated and it is often regarded as a **messy, hole-and-corner job.** A straightforward layout of the plant, with well drained floor, adequate lighting and efficient ventilation, should be the aim on economic and moral grounds.

"The grade of operative is important—unskilled men may be used but they are seldom encouraged to take an intelligent interest in the job and suggestions from them and the engineering staff should be welcomed.

"It is only by such means that barrel polishing will continue to progress and the hope is expressed that interest has been awakened in the possibilities of the processes available."

How truly Dr. E. G. West, B.Sc., Ph.D., who delivered this paper has

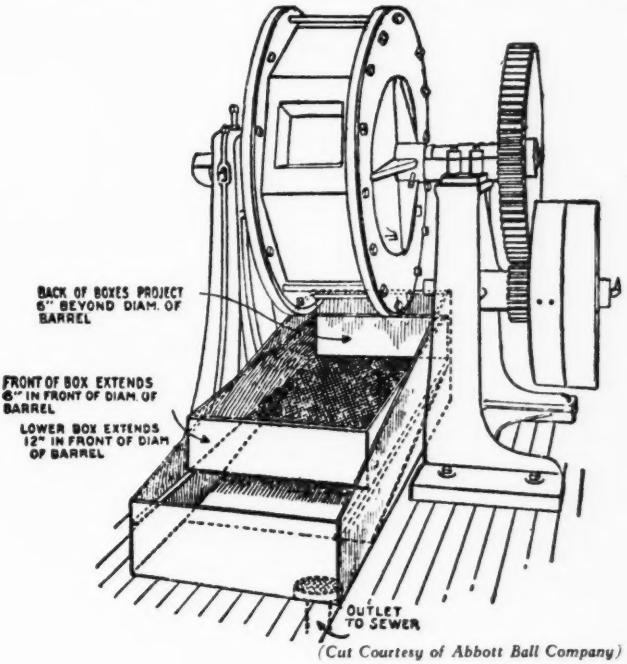
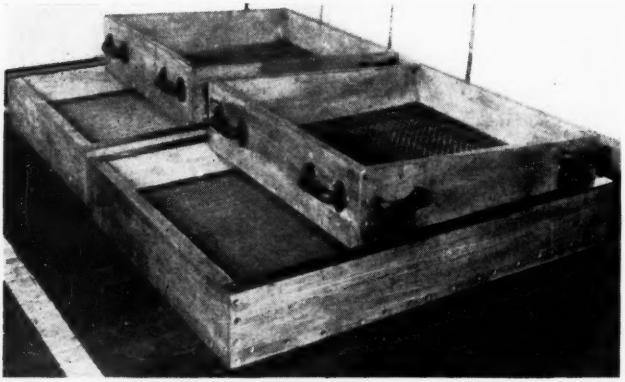

BACK OF BOXES PROJECT 6" BEYOND DIAM. OF BARREL
FRONT OF BOX EXTENDS 6" IN FRONT OF DIAM. OF BARREL
LOWER BOX EXTENDS 12" IN FRONT OF DIAM OF BARREL
OUTLET TO SEWER

Fig. 1 — Illustration showing set-up of an Abbott double unloading tray.

(Cut Courtesy of Abbott Ball Company)



(Photo Courtesy Baird Machine Company)

Fig. 2—Baird double unloading trays of the type shown here are equipped with rollers between the upper and lower tray.

pictured the barrel finishing department of the average American plant. If the readers of this series who are interested in barrel finishing procedure might have accompanied the writer on the hundreds of "little journeys" he has taken to plants all over the country, they too would realize that there is room for vast improvement in the manner in which the work is ordinarily carried out.

Inasmuch as this paper discusses factors in unloading barrels we might perhaps best look into the best suggested methods now being used. By far the widest used instrumentality is the double tray, that is, where the mass of burnishing material and parts are poured from the barrel into a double tray, the first or upper being of screen mesh or perforated metal, and the lower being the receptacle for receiving the burnishing materials separated from the work in the upper tray. These trays are comparatively simple in their construction, the outer one being sufficiently larger than the inner one so that the inner or screen tray may be riddled back and forth to separate the parts being finished and the steel or other burnishing materials.

Usually, the inner tray is supported either on a metal clad cleat or angle iron firmly attached to the inner side of the larger tray, but the inner tray should always have some device such as rollers to facilitate its movement back and forth for otherwise this resolves itself into literally a "back breaking" job for the barrel operator. For the most part such trays do not have rollers, and if manufacturers have any regard for their production costs they would see to it that all double trays were so equipped for loads of parts can be separated from the steel burnishing materials in at least half and in some cases less than half the time required when non-roller trays are used.

One of the most popular layouts, used for the most part on the typical high and narrow barrels, is that of the Abbott Ball Company of Hartford, Conn. An illustration of an Abbott double unloading tray is shown in Fig. 1.

Following this, we have a suggested form of double unloading tray as suggested by The Baird Machine Company of Bridgeport, Conn., which is illustrated in Fig. 2.

This type of tray is used as shown in the illustration. It is made in two separate sections so that either single or double barrels may be unloaded as required, and inasmuch as it is portable, there is no necessity for having a tray for each barrel, due to

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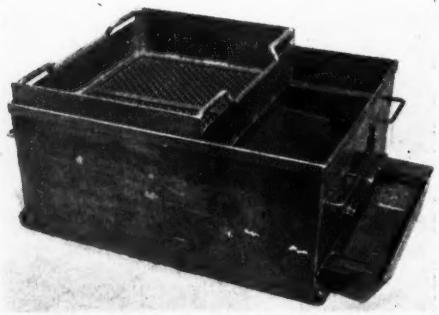
the fact that this assembly can be moved about at will. We are happy to be able to reproduce the photograph of this tray because it illustrates so very clearly the use of rollers on the inner tray assembly to facilitate the riddling action necessary in separating the parts being finished from the steel burnishing material. In these particular trays, wood was considered as satisfactory material, but practically the same type of tray can be just as well made from metal. Either the wood or metal tray can be fitted with skids or casters to provide for greater ease in moving the assembly from one barrel to another.



(Cut Courtesy Storts Welding Company)

Fig. 3—An all metal ball control unit which incorporates the best features developed thus far for such a device.

We have had many inquiries regarding the screen considered best to use on the separator tray, that is, whether a mesh screen or a perforated metal screen would be best. To this we can only say that we consider this as simply a matter of choice, since one will function as well as another. There may be an element of greater speed in the perforated sheet metal bottom as against the woven wire mesh. The principal factor, however, is to select a size of material that will most readily permit the passage of the burnishing material and at the same time hold the parts being finished on the upper tray. Care, of course, should be exercised to select a screen that will not permit some one or more projections of the parts being finished to slip into the mesh of the screen and thus retard the separating operation.

As we have previously stated, barrel manufacturers except in isolated cases, do not supply these unloading trays. We are glad to note, however, that we now have one concern who is giving a great deal of thought and attention to this phase of burnishing barrel operation. In June of the current year this company announced its first design of a double unloading tray made entirely of metal. We are indebted to the Storts Welding Company, of Meriden, Conn., for the illustration showing this first development. This assembly apparently embraces the most important factors, and is a composite of all the best features that have thus far been developed in such a device.

We have been assured by the Storts Welding Company that this first effort on their part is but the beginning of a study of this most important factor, and that further developments may be expected from them. The ruling factor in their developments will be to produce an instrumentality which, to use their own language, will "make balls behave."

All of the foregoing is interesting in showing what has thus far been developed, and the question will naturally arise as to what would be the best sizes to make these trays, for various sizes of barrels. Quite naturally the capacity of the barrel, that is, the bulk of both burnishing ma-

terial and parts being finished must be considered. This brings us to some of our own research on this same subject, and which we outline as follows: The following outline sketch is supposed to represent the bottom of a burnishing barrel over a pair of unloading trays similar to those shown in Fig. 1. The suggested sizes for both inner and outer trays are as follows:

Outer Box Dimensions

Size of Barrel in Inches	Length of Box in Inches	Width of Box in Inches	Height of Box in Inches
24x8	54	22	8
24x16	54	30	8
30x8	60	22	8
30x16	60	30	8

Inner Box Dimensions

24x8	47	Slides inside	9
24x16	47	of outer	9
30x8	53	tray	9
30x16	53		9

The material generally used on assemblies like the above is 22 gauge Galvanized Iron. The tops of the boxes or trays may be finished either with a wire or flanged edge, as preferred.

When the types of unloading trays described are used, irrespective of the type of barrel, whether high and narrow, or long and narrow, there is a considerable distance or drop of burnishing material and parts as well as soapy burnishing lubricating solution from either the lip of the long and narrow barrels or the edge of the opening in the high and narrow barrel to the unloading screen. Herein lies the most prolific source of loss of burnishing materials.

Anyone familiar with barrel operation knows to just what extent steel balls or steel forms will bounce when they strike parts in process or other burnishing materials on the screen or from the screen itself. Even though

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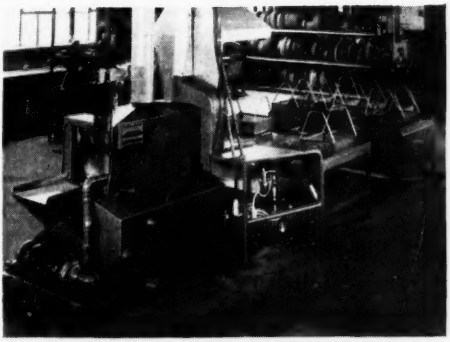

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the operating conditions are such that this material may be swept up and reclaimed prior to its rusting, there is the loss of time involved in

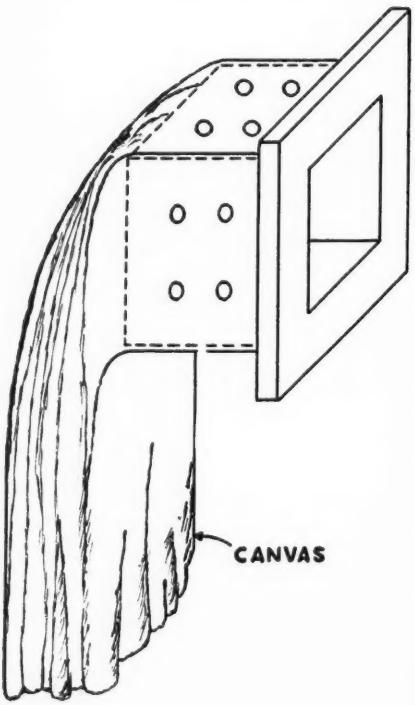


Fig. 4—This drawing illustrates a loading chute equipped with canvas tube for unloading the entire barrel load.

such salvage proceedure that must be considered as a part of barrel finishing expense. Practically all of this loss and reclamation expense may be eliminated by the adoption of one of two very simple devices. The first device is shown in Figure 5.

This rough sketch of such an unloading chute represents what might be termed an auxiliary or replacement cover for a typical high and narrow barrel. It is tapered on the sides so that it wedges under the side lugs cast on the barrel inner edge, the lugs provided holding the cross locking bar. A simple hex head screw may be run through the top side so that simply tightening this screw with the regular barrel wrench will hold it securely in place. Once this is done, the barrel may be tipped and held at its lowest unloading position, and by use of the gate in the bottom of the device only as much of burnishing material and parts that can conveniently be handled may be withdrawn from the barrel.

The lid is gasketed, and there is no splashing of water or bouncing about of burnishing material or parts, and simple as it is, it constitutes a complete answer to every objection raised against barrel finishing as being a wet, sloppy or messy operation, because this is completely eliminated. Not only this, but smaller and far more flexible double unloading assemblies may be used.

By releasing only parts of a load at one time the operation of riddling is much simplified and the back-breaking job of moving a load of one thousand pounds of burnishing material and parts is completely eliminated. The lower pan may be made sufficiently large to contain the entire load of burnishing materials, but the inner pan may be much smaller and far easier to handle.

As a modification of this, and preferred by some is much the same sort of a chute but without a gate for unloading. This is made by shortening the throat of the chute, drilling six holes on each of the four sides and then fitting the end of the chute with a heavy canvas tube, or what might perhaps be expressed as a bottomless canvas bag. This bag is made in size so that it will fit

snugly over the throat of the chute and is fitted with grommets (eyelets to some) and small bolts are run through these grommets to fasten the canvas chute to the throat of the unloader. If this device is used, the entire load of water, burnishing material and parts are deposited on the screen in a single revolution of the barrel, and as the entire load deposits directly into the upper tray, the same objection to sloppy operation, undesirable working conditions and loss of burnishing materials is also eliminated.

While both of the foregoing chutes are shown with square base, being intended as lid auxiliary replacements for high and narrow barrels, they may be adapted to long and narrow barrels equally as satisfactorily by simply making the base round or octagonal as the case may be, and with slots or other changes to adapt it to whatever type of barrel on which it is intended to be used.

We believe that these two instrumentalities mark the most forward step thus far in barrel unloading with

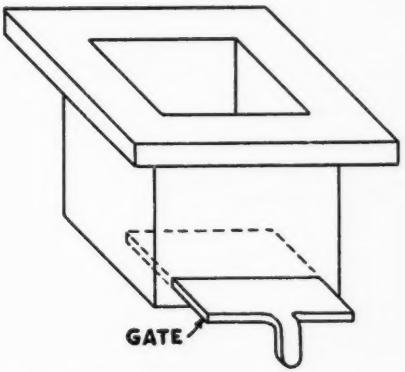
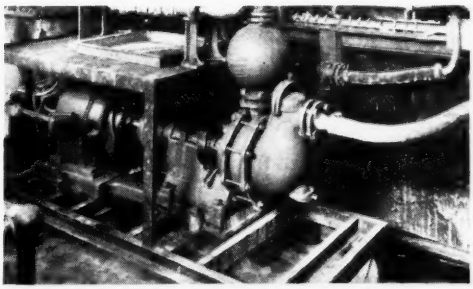


Fig. 5—Drawing illustrating a loading chute designed as a replacement cover for a typical high and narrow barrel.

Portable Duriron Equipment



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the elimination of wet and messy conditions as well as the conservation of time, man power and burnishing materials. Perhaps like everything else, readers will see the utility of such a device and say to themselves "I'll have to build one of those," and then never get around to the actual doing of it. We have supplied a number of both types to some of our research clients and if sufficient interest is shown, we will arrange to have more of them manufactured, and we know of no single instance where either type has been used, that the operator would willingly go back to previous outmoded methods.

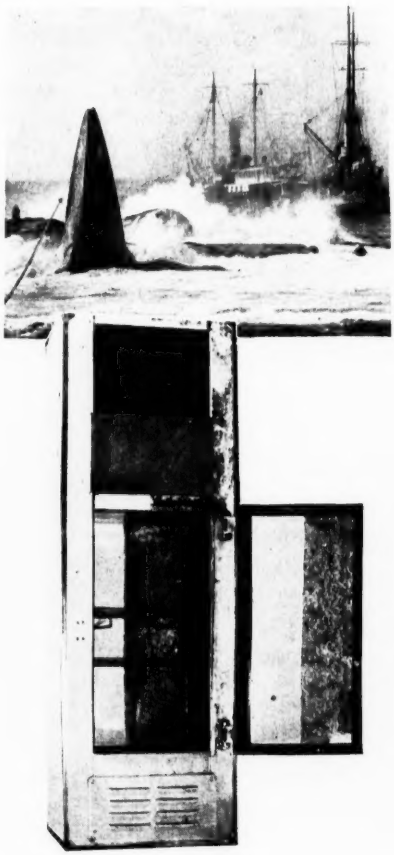
This discussion, of course, has to do only with getting the burnishing material and parts out of the barrel, but in next month's discussion we will review the factors deemed to be the most effective and important for transferring the burnishing material back to the barrel after the completion of each load, a subject equally as important as unloading.

Tale of a "Squalus" Survivor

WHEN the submarine Squalus sank off the coast of New Hampshire last year, the porcelain enameled finish on the craft's refrigerator was given a test more vicious than those any laboratory is likely to devise.

The refrigerator box was just returned to Toledo Porcelain Enamel Products Company for cleaning and the manner in which porcelain enamel stood this test, according to E. L. Adams, vice president of Toledo Porcelain, gives housewives, appliance dealers and manufacturers a dramatic demonstration of the rugged durability of this age-old finish as it is applied today.

For 113 days the Squalus lay on the bottom of the ocean off Portsmouth Harbor, New Hampshire. But it didn't lie quietly. Time after time rescue crews pulled it to the surface. On one occasion, according to the New York Times, "the bow shot almost vertically out of the water in the midst of salvage operations. Then it dropped back and sank again to the bottom of the ocean 240 feet below." There it was rolled by the current which buffeted and strained everything within it.



Without a permanent stain or injury of any sort the porcelain enamel on this refrigerator from the Submarine Squalus withstood 113 days submersion in salt water on the ocean floor. Half of each panel was washed with soap and water to restore the porcelain to its original lustre.

Water from a faulty intake valve that failed to close properly, according to news reports, sank the boat and flooded certain compartments. Battery acids and then salt water, plus the abrasive action of sand and silt bound together with a scum of Diesel engine oil, all had a hand in subjecting the refrigerator finish to one of the stiffest tests a kitchen appliance is ever likely to meet.

When the Squalus was towed, bumping along the ocean floor, into the Navy Yard for overhauling, the refrigerator was removed and sent to the manufacturer, the Herrick Refrigerator and Cold Storage Company of Waterloo, Iowa, for repair. They in turn sent the porcelain enameled box to the Toledo Porcelain Enamel Products Company, Toledo, Ohio, which had originally applied the finish.

At the enameling plant, when the usual soap and water scrubbing revealed the finish underneath absolutely unharmed and possessing its original lustre, just half of each panel was washed and the box was photographed to show "before" and "after" effects of the test. Acids, abrasives and strain had not made the slightest impression on the finish, as the photograph indicates.

The Herrick Company, recognizing the display value of this interesting testimony to the stamina of modern porcelain enameled refrigerators, retained this one and supplied the recently rechristened Squalus with a brand new box. Units for this refrigerator and four others which are in use on sister submarines — Swordfish, Sculpin, Searaven and Seawolf — were furnished by the Kelvinator Corporation, Detroit.

The Jessop Steel Co., Washington, Pa., has recently installed a large drum type grinding and polishing machine for finishing sheets and plates up to 50 in. wide by 14 ft. long, of any type metal, especially stainless steels and Silver-Ply stainless-clad steels.

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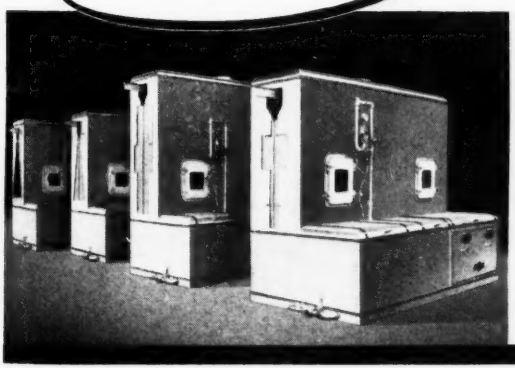

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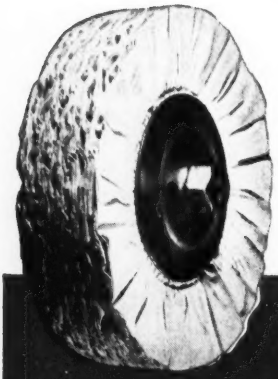

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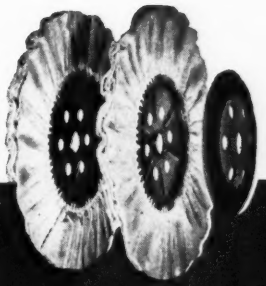

F CORPORATION
LONG ISLAND CITY, N. Y.

MODERN GOLD PLA

By Joseph B. Kushner, Ch.E.

Metal Finishing Consultant

THE voltage generated by an internal battery used in salt water gold plating is so low that the current produced by immersing work in the gilding compartment is necessarily of a very small order. While one cannot deny that the gold deposits obtained in this manner are dense and fine grained, the low current density precludes the use of this method of gold plating where production must be maximum. For this reason, the trend in modern gilding has been toward the use of an external electromotive force as a source of current for plating.

External cells for gold plating are first mentioned in British Patent No. 8447 granted to the Elkington Brothers in 1840, in which they mention the use of a "sustaining" battery. As they themselves state, "We claim the application of a galvanic current in connection with solutions for gold and silver as above described." The formula they recommended for current plating with gold consisted of: "31.25 grams of gold as oxide, 500 grams Prussiate of Potash, in 4 liters of water." In passing, we may say that this formula is still a good one.

Incidentally, the phrase "Prussiate of Potash" was the cause of a disagreement between the Elkingtons and the Frenchman, De Ruolz, who claimed to be the first user of potassium cyanide for gold plating work. As most of us know, the name prussiate of potash, generally refers to either potassium ferricyanide or potassium ferrocyanide and not to the simple cyanide of potassium. In view of this common usage, it was construed that the Elkingtons meant one of these complex iron salts. De Ruolz claimed to be the first man to use potassium cyanide for gold plating but this was contested by the Britishers who eventually managed to convince the world that they had meant prussiate of potash to be potassium cyanide.

Cyanide has almost universally been employed in gold plating since that early day. Deposits from cyanide baths are so superior to deposits produced from any other gold baths, and the cyanide solutions are so much more stable chemically, that cyanide is a literal chemical "must" in electrogilding.

Of course, other types of gold salts can be used for plating[1] such as the halides and thiosulphates but the only

1. These will be discussed in future papers.

LDPLATING - PART 3

really successful gilding baths to the present date have been those which contain cyanide.

Gold forms two simple compounds with cyanide, aurous cyanide, Au (CN), in which gold has a valence of one and auric cyanide, $Au(CN)_3$ in which gold has a valence of three. These compounds combine further with the alkali cyanides to form complexes as shown in the equations below:

$Au(CN) + KCN = KAu(CN)_2$ (potassium aurocyanide)

$Au(CN)_3 + KCN = KAu(CN)_4$ (potassium auricyanide)

In ordinary cyanide plating baths gold exists only in the monovalent form, that is, as the aurocyanide. Very small amounts of the auricyanide may form, but these break down to the auro salt, since this is the more stable of the two.

While we are not going to attempt to go too deeply into the actual chemistry of gold plating, there is some interest in examining its mechanism. The aurocyanide ionizes in the following way: $KAu(CN)_2 = K^+ + Au(CN)^-_2$. The potassium ion having a positive charge migrates to the cathode where it combines with some of the non-dissociated salt to precipitate gold and liberate potassium cyanide, as shown in the equation

$$K^+ + KAu(CN)_2 = Au + 2KCN$$

Whether this actually occurs as described above is still in question, since we cannot be too sure that the electrodeposition of gold is the secondary process pictured here or a primary process in which small quantities of positively charged gold ions travel to the cathode and are deposited direct-

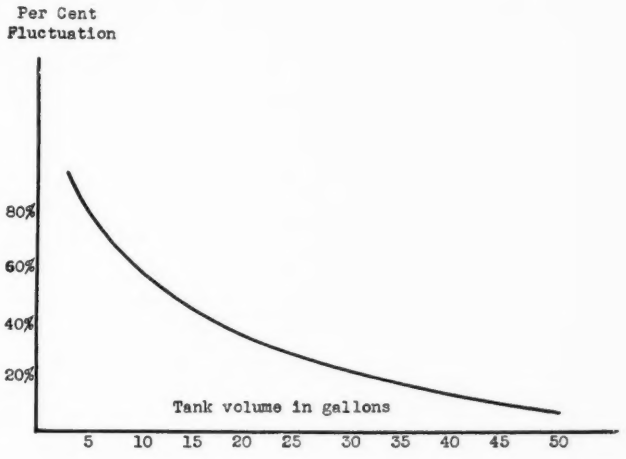

Fig. 9—Curve showing the daily fluctuation in gold content for a given daily load as it varies with the size of the tank.

ly. In any case, the explanation given seems pretty reasonable, so we'll let it go at that.

The gold ions are released so slowly from the aurocyanide that depositing gold crystals do not have an opportunity to grow large and rough. Furthermore, the compound is so complex that it cannot be readily decomposed (it takes boiling with powerful acids to do it) as other gold salts. These are the outstanding advantages of the gold cyanide bath. On the liability side is the fact that potassium cyanide is an extremely violent poison if taken internally. In fact, as an old chemistry professor of ours once humorously put it, "It's so deadly a drop on a dog's tongue will kill a man in five seconds!" On the other hand nobody goes around tasting the stuff, and the release of hydrocyanic acid gas because of a reaction such as this—$CO_2 + H_2O + 2KCN = K_2CO_3 + 2HCN$—is negligible, if not doubtful. With reasonable precautions no harm comes to him who operates a cyanide gold bath.

As for the alkali metal to be used in combination with the gold cyanide, the invariable choice of the experienced plater has always been potassium. Potassium cyanide seems to somehow give finer grained deposits that are more amenable to buffing than those obtained by using its sister salt, sodium cyanide. The potassium salt has a higher conductivity as well, so less electrical energy is required to get the same result. Another marked advantage is based on the question of carbonates. Sodium carbonate is approximately one-third as soluble as potassium carbonate. This means that in a sodium cyanide gold bath, the carbonates formed by decomposition will begin to precipitate rather early in the reaction, causing troublesome spots and films on the deposits, whereas potassium carbonate will remain in solution at the same concentration and keep out of mischief. The old-timers also claim that with potassium baths they can work within a wider range of conditions (current, temperature, and so on) and still produce uniform results.

During the first world war when we were cut off from the source of potassium cyanide (Germany) recourse was made to the sodium salts, but since then the drift has been back to potassium in spite of the educational program of certain manufacturers of sodium cyanide. During the present war, even though we are cut off from the source again, an American concern has begun to manufacture potassium cyanide in commercial quantities and we are happy to announce that it is every bit as good as, if not better than, the imported material.

The only substantial advantage that sodium cyanide has to offer is low cost and the added fact that lesser amounts are required to provide a given amount of cyanide radical in the bath (consult the molecular weights).

Ammonium cyanide seems to be out of the question altogether, since it decomposes far too readily. We at one time seriously considered the possibility of using the ammonium salt, but gave it up as a bad job when we obtained a mess of brew reeking with ammonia fumes and other smells far more toxic in nature.

At one time, some thought that a great many other substances were needed besides gold and cyanide in an electrogilding bath (some formulas based on this philosophy were published in Part II). Actually, there are but two essential constituents—potassium aurocyanide to deposit the gold and a little extra cyanide (free cyanide) which may be added to help

conduct the electric current.

Potassium or sodium carbonate may be added to increase the conductivity of the solution or as an alternative for the same purpose, sodium or postassium diphosphate may be employed. Incidentally, phosphates seem to increase the fineness of the deposited structure, making the gold plate lighter and brighter in appearance. This, most likely, is due to an additional complex formed by the phosphate, the cyanide and the gold.

Other salts are sometimes used in limited quantities, such as the yellow prussiate of potash (potassium ferrocyanide) and ferric chloride, but we have yet to see the marked advantages reputedly obtained by their use in gold plating baths. Sodium sulphite or bisulphite is another salt which has been used frequently. This may be of some value, inasmuch as the sulphite radical may have a slightly protective effect on the cyanide by preventing its too rapid oxidation and (or) hydrolysis. Certain other compounds have been recommended from time to time in the literature of gold plating. We will deal with these as we get to them.

In the matter of pH and gold plating, we have performed only few experiments, but at the present time we are fairly convinced that the pH of a pure gold solution has relatively little effect on the structure of the gold deposit. At least, no palpable changes are visible. When it comes to alloy gold plating pH is of some consequence and it will therefore be discussed more fully under this subject.

Plating With Pure Gold

A plating bath that contains no heavy metals other than gold will deposit the gold, theoretically at least, in pure form. Actually, the deposit

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is somewhat less than 1,000 fine, as some of the heavy metals are always present inasmuch as they occur as impurities in the cyanide and eventually deposit with the gold or because certain organic colloidal material which is also present behaves cataphoretically and deposits likewise. Practically, though, we may consider the deposit to be 100 per cent gold. The fine gold finishes go by a number of names in the trade, so we will not attempt to give them. Their colors, although they contain nothing else but gold, may vary from pale yellow to reddish yellow, depending on the conditions of deposition.

Simplest of all gold plating formulas is the following, consisting of only two components:

Potassium aurocyanide	½ oz./gal.
Potassium cyanide	½ oz./gal.
Temperature	120-140 deg. F.
Voltage	1-3 volts

This bath produces beautiful yellow deposits and is very simple to operate.

A good variation of this bath which is perhaps better suited for flash deposits can be made according to the following formula:

Potassium gold cyanide	½ oz./gal.
Potassium cyanide	1 oz./gal.
Potassium carbonate,	1 oz./gal.
Temperature	140-150 deg. F.
Voltage	5-6 volts

In Providence, one of the centers of the "junk" jewelry industry, production rates are high and thousands of novelties are gold plated daily. If much time had to be spent in gilding these pieces, costs would go up tremendously and the ladies would have to pay much more of our money for some of the gadgets and baubles they now get at "such a bargain." As a result, the modern production gold plater likes to work with gold plating solutions that put on a minimum of metal as fast as possible. This type of plating, as most of us are aware, is known in the parlance as "flashing." Gold is deposited on the work in 30 seconds or less and the deposits are generally no greater than .00001 in. in thickness. Here is a typical formula for this kind of operation:

Potassium gold cyanide	½ oz./gal.
Potassium cyanide	1 oz./gal.
Sodium diphosphate.	2 oz./gal.
Temperature	150-180 deg. F.
Voltage	7-20 volts

At this point we would like to discuss and analyze the gold plating procedures found in shops which are located in and around the city of Providence, Rhode Island. The plating practice there is something as follows: The metal trinkets, which are usually made of either brass, copper or white metal, are usually given a very light deposit from a hot brass solution (occasionally a copper or nickel deposit may be put on first), after which the work is flashed in the gold solution for about 10-30 seconds, the time being determined by whether the work is uniformly colored or not. The plating solutions, with exception of the nickel, are held in 4 to 5 gallon pyrex pots mounted on a steam table somewhat similar to those seen in restaurants and cafeterias. The gold baths do not have their own temperature control, but simmer along with the other pots at temperatures that are infrequently or never determined.

These pots are rarely, if ever, replenished with fresh gold after once being made up, since they are operated with stainless steel anodes. After

a certain number of pieces have been plated in a pot, the solution is dumped into a crock or barrel for a refining treatment. In large plants where the production is very great, these solutions may be dumped as frequently as twice a day.

When asked why he prefers to dump the gold solution and make up a new one in preference to replenishing it, the old-time Providence plater will tell you that he cannot obtain the same shade of gold previously plated, if he does this, thus he finds it is cheaper to make up a new bath.

It is almost unbelievable that such a primitive and crude method of gold plating should exist today.

Common sense rebels against this make-up, dump-out policy (who ever heard of a nickel plater dumping a nickel bath at the end of a long production run simply because it was low in nickel content and had to be replenished with some single salts?). It certainly would be better practice to use a larger gold tank and replenish it properly instead of spending time making up a new one. Yet the make-up, dump-out policy persists because it is brought about by lack of scientific control in the manner applied to a nickel bath, for example.

The excuse is often made by the manufacturer and plater, well, we're only plating this stuff for color, no heavy deposits, we can't waste time controlling these baths. We get our production out and we're satisfied.

The process is wasteful nevertheless. The writer, who has worked with the novelty people in and about Providence, knows it. Production is obtained that is true, but at an unnecessarily high cost in gold and labor time.

It is interesting to see why this is so. In the first place, the pots used for holding the solutions are far too

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small for the volume of work that passes through them. Take for example, a five-gallon pot as a working basis. If the pot holds, initially 1 to 1½ ounces of pure gold it will be a lot. Naturally, in such a small pot chemical unbalance of the electrolyte is quickly felt. If the gold concentration in the pot is .25 oz. per gal. and at the end of the day an ounce of gold has been taken from the pot (deposition plus wastage) the concentration of gold in the pot drops to $\frac{1.25 - 1.00}{5} = .05$ oz. per gal. This is a fluctuation of 80 per cent in gold content. Naturally, much poorer results will be obtained toward the end of the working day in a case of this kind.

Let us suppose the tank holds 50 gallons of solution at the same initial concentration. After running it for a day, we have taken out one ounce of gold again. By the same figuring, the final concentration of gold in the tank is .23 oz. per gal. and the fluctuation in gold content is only 8 per cent. If the tank is 500 gallons in capacity, the fluctuation is only .8 per cent. A curve of this function is shown in Fig. 9. As shown, it is a hyperbola of the form $xy = K$.

Of course, gold inventory has something to say with regard to the size of the tank used, but wherever production work is done there is always a happy medium between the size of the gold tanks used and the savings involved which can be fairly easily computed.

A second item is the fact that little or no temperature control is observed. The pots will very often be found to be running almost at the boiling point. Little thought is given to the decomposition of cyanide at high temperatures. Hydrolysis, oxidation and general breakdown proceed at a merry rate so that at the end of the day, or even much before it, the tank is far too low in free cyanide. The experienced plater naturally drops in a few balls of cyanide to make up for this loss—but does it? The decomposed cyanide has been converted mostly to carbonates with a resulting increase in the electrical conductivity of the bath; the new cyanide additions further increase the conductivity. As a result, new electrical conditions are produced. If, for example, the total resistance of the bath with certain work in it is 1 ohm and the voltage applied across the bath is 6 volts, then according to Ohm's Law we get a current of $6/1 = 6$ amperes. After a day's run in the small pot, the resistance may drop down to ½ ohm. This means that 6 volts across the tank will permit 12 amperes to flow. Most platers in these plants do not have ammeters, but operate by means of voltmeters. The voltmeter reads six volts across the line at the beginning of the day and at the end of it, but the current density on the work has gradually been doubled during the same period.

With such large changes in current density, the nature of the gold deposit is bound to change. No wonder some platers wonder why their gold deposits get redder as they go along during the day in spite of the fact that they know there is plenty of gold in the tank. The increased current density of which they are unaware is the sole cause. Even cathode efficiency may be affected by the increased current density, causing a longer time interval to obtain a satisfactory gold deposit.

Item three deals with anodes. Gold anodes are rarely used these days in production plating because the gold dissolves chemically as well as anodically in cyanide solutions with a resulting tendency to gold enrichment

and needlessly high dragout losses and gold inventory. This being the case, insoluble anodes generally made of stainless steel or iron, are used. (Carbon anodes were highly favored at one time, but carbon is porous and absorbs a considerable amount of gold and it tends to distintegrate in the solution with the formation of fine insoluble particles, giving rise to spots and stains on the work.)

The question is, are these anodes insoluble? The answer, in most cases, is no. The old-time platers cut down their own gold as described in Part I of this paper. They use plenty of muriatic acid and then, almost always, fail to remove it by proper purification. What happens? The chlorides that remain attack the steel or iron anodically and bring it into solution. After a while there is enough iron in the electrolyte to give the gold plated work a peculiar purplish off-color hue which cannot be eliminated no matter what the plater tries.

Item four is contamination. This is inversely related to the first item mentioned, depletion. The work that goes into the five-gallon pot is generally brass plated first. Now it so happens that electroplated brass is particularly prone to attack by cyanide (see the reaction for this attack in Part II) and gradually, copper and zinc begin to adulterate the solution. Since the pot size is too small for the work that goes through it, the contamination is quickly felt and the gold rapidly goes off color.

The last but not the least important factor is free cyanide. In a pure gold plating bath, a fairly wide range of gold concentrations can be obtained without undue results on the color of the deposit but the free cyanide must be kept within a limited margin to hold on to that color. As the day progresses, the plater notes that the color is going off unexpect-

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edly. He adds a little more cyanide and finds it does not help, so he decides the bath needs gold. He adds gold from his own prepared stock solution which in itself contains a considerable excess of free cyanide. With this now large excess of free cyanide present in the bath he still obtains poor results and must experiment further to improve his deposits.

All of these items are responsible for the make-up, dump-out policy in novelty gold flash plating that exists today. We insist that this wasteful policy is not necessary and contend that gold plating can be placed on a scientific basis. Fortunately, an educational campaign by the writer and several others has awakened a considerable interest in more scientific gold plating. It is both gratifying and heartening to learn that one of the largest novelty jewelry houses in the business has just installed a scientifically designed and controlled plating department and we freely predict the other companies are soon going to fall in line and do likewise.

High Speed Brass Plating

A NEW brass plating process, which which is said to be two to four times as fast as present processes, has been announced by the Electroplating Division of E. I. du Pont de Nemours & Company, Wilmington, Del. The process has been developed to provide a brass plating method which will yield smooth, bright deposits of controllable thicknesses at a more rigid rate of deposition.

The process makes possible heavy deposits of brass, 0.001 of an inch or more in thickness, in a reasonable time where before heavy deposits could not be obtained at all. Prepared High Speed Brass Salts provide a simple, quick preparation of a new bath, which will plate immediately, eliminating the "breaking in" period necessary before satisfactory results are obtained with the present processes.

The process operates without polarization at high anode current densities, giving proper composition and color of plate and the purity necessary to maintain the efficient operation of the bath. Addition agents prevent pitting, improve lustre and prevent objectionable fumes.

The relatively low temperature of operation, 40 deg. to 50 deg. C. (105 deg. to 125 deg. F.), assures ease of control and economical operation. A uniform bright yellow color may be obtained over a wide range of current densities. This means that uniform color over recessed objects is now possible. The characteristics of the deposits may be constantly maintained throughout the process by means of definite chemical control.

The Du Pont High Speed Brass process is one of the few significant changes which have occurred in brass plating practice in the last 20 years. Heretofore only very light weight deposits have been obtained at very low cathode current densities. The new process, because it is applicable to all brass plating operations, will place this operation on a scientific basis. It is expected that with heavy deposits economically possible, the thickness of brass deposits will undoubtedly be specified as is common practice with other electro-deposited metals. The purchaser of brass plated objects would then be able to order according to specifications and know definitely what brass plating deposit he will receive.

A brief comparison of the former practice and the newly recommended

procedure is as follows:

Brass Plating (Former Practice)	**Du Pont High Speed**
Solution Composition	
Copper Cyanide ..... 4 oz./gal. Zinc Cyanide .....1¼ oz./gal. Sodium Cyanide .....7½ oz./gal. Sodium Carbonate .... 2 oz./gal.	Du Pont High Speed Brass Salts 3.4 lbs./gal. Addition Agent 2 cc/gal.
Operating Condition	
Anodes: Brass 70 to 80 per cent Cu 30 to 20 per cent Zn	Du Pont High Speed Brass Anodes: Cu 70 per cent Zn 30 per cent
Temperature: 75 deg. to 100 deg. F.	105 deg. to 125 deg. F.
Permissible Anode Current Density—Without polarization 2-4 A/SF	Up to 25 A/SF
Anode Efficiency—Very poor except at very low anode density	90 to 95 per cent up to 25 A/SF
Cathode Current Density: 2-10 A/SF	10-25 A/SF
Cathode Efficiency: 20 to 50 per cent	50 to 80 per cent

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PRETREATMENTS FOR SOUND ENAMEL FINISHES ON ZINC ALLOY DIE CASTINGS

By E. E. Halls
New Barnet, Herts., England

ZINC modified by means of suitable alloying elements such as aluminum, copper and magnesium, has long since been recognized as a highly desirable material for pressure diecasting into complex configurations. The primary reasons for its attractiveness are low casting temperature with consequent small wear upon dies, small shrinkage due to combined effects of solidification and cooling from casting temperature, maintenance of dimensions to close tolerances, long die life and retention of good surface appearance. Secondary factors are low material cost, sound castings, good mechanical strength, no undue corrosion troubles, manipulability through machining operations such as tapping, and easy response to controlled processing in finishing with electroplate or organic coatings. Undoubtedly, America is responsible for the re-establishmcnt of zinc as a die casting material. Development and research over many years in that country have covered all aspects so that the sound casting, manipulation and usage of zinc alloy castings have probably approached perfection not only more rapidly, but more completcly than is the case with any other casting alloy.

Phases of zinc alloy die casting which have been fully covered by American research and industrial organizations include the determination of the causes of early failures, the commercialization of a range of thoroughly reliable alloys for general purposes, the establishment of standardized control tests for "stable" zinc alloys, the devising of good general casting technique and in particular the availability of machines and methods for rapid and safe production of castings at high pressure with freedom from internal and superficial defections, the evolution of methods and pre-cleaning and electroplating, and of chemical surfacing and enameling. In fact, other countries are still lagging and showing reticence in applying this knowlcdge, much of which is now backed by very many years of service in the field. This particular article is concerned only with one aspect of the zinc alloy die casting business, namely, organic finishing with special reference to chemical pretreatments.

Zinc in the form of castings, sheet metal work, galvanizcd or electroplate coatings, has always presented its own finishing problems, and finishes initially adherent have never

been regarded with certainty in service, due to the fact that often flaking and peeling occur prematurely. Various reasons have been given to explain this shortcoming. The smooth, somewhat shiny zinc surface has been described as "greasy." The highly reactive zinc has been said to react with the acidic resinous or fatty bodies in the organic coating. Moisture penetration of the covering film reacting with the zinc surface has been said to weaken the bond. One or all of these theories may be correct, and while some alleviation of the troubles has been obtained by roughening treatments such as sand or shot blasting, and by selection of the best organic media by trial and result methods, the fact that assured adhesion is difficult to obtain is all that concerns the practical man. The problem has been solved by chemical pretreatments, and by adopting one of these proved methods, any of the ordinary organic finishing media of good quality can be used with certainty. This applies to oil base, synthetic or cellulose products, air drying or baking varieties.

The function of the chemical pretreatment is two-fold, namely, the production of an inert surface layer and the provision of a key for the enamel coating. Many types of chemical solutions are satisfactorily employed to this end, but those of outstanding merit fall into two groups, phosphate and chromate.

The phosphate solutions can be made up from mixed chemicals or from proprietary compounds. The latter are advocated because they are provided either in the form of two chemicals, one for initial make-up and one for replenishment, or as a single compound suitable for both purposes. Control in operation is achieved

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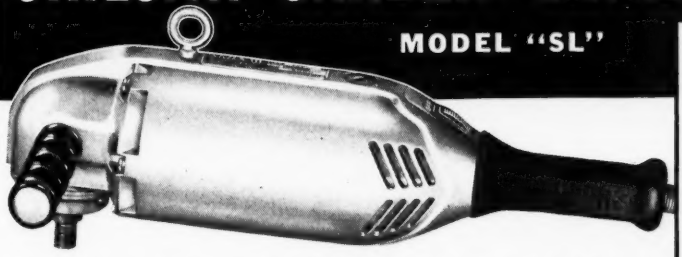

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TABLE No. 1

Performance of Enameled Zinc Alloy Die-Castings Under Hot and Cold Humidity Conditions

Sample No.	Constitution of Finish	Chemical Pretreatment	Performance Under Test
1	1 coat yellow chromate primer, stoved, synthetic 1 coat green finishing enamel, stoved, synthetic	None	Finish softened and easily peeled in 4 weeks
2	Same as No. 1	Phosphate	No change in finish, either visual or in adhesion, in 18 months
3	Same as No. 1	Chromate	
4	1 coat red oxide primer, stoved, synthetic 1 coat green finishing enamel, stoved, synthetic	None	Finish softened and easily peeled in 4 weeks
5	Same as No. 4	Phosphate	No deterioration in appearance or adhesion in 18 months
6	Same as No. 4	Chromate	
7	1 coat aluminum, stoved, synthetic 1 coat varnish, stoved, synthetic	None	Gradual loss of adhesion and softening of finish which could easily be peeled by thumb nail in 4 weeks, much blistered in 8 weeks
8	Same as No. 7	Phosphate	Entirely unaffected in 18 months
9	Same as No. 7	Chromate	
10	2 coats green cellulose enamel	None	Adhesion very poor in 4 weeks
11	Same as No. 10	Phosphate	No deterioration in appearance or adhesion in 18 months
12	Same as No. 10	Chromate	
13	1 coat aluminum cellulose	None	Adhesion very poor in 6 weeks
14	Same as No. 13	Phosphate	Entirely unaffected in 18 months
15	Same as No. 13	Chromate	
16	1 coat cellulose/glyptal synthetic lacquer, air drying	None, but polished or shot blasted	Polished sample satisfactory, shot blasted sample looking "dirty" in 18 months. Adhesion of lacquer good.
17	2 coats green finishing enamel, stoved, synthetic	None	Loss of adhesion in 4 to 5 weeks, finish very easily peeled off with thumb nail
18	Same as No. 17	Phosphate	Appearance and adhesion unchanged in 18 months
19	Same as No. 17	Chromate	

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chemically by simple process of alkalimetry. As the reactions that occur in processing are somewhat complex, it is difficult when preparing one's own chemical mixtures to maintain a uniform balance in the solution without much research work, and in general it is more economical to take advantage of that already commercialized by industrialists specializing in chemical pretreatment.

Prior to chemical pretreatment, castings must be chemically clean. Lubricants, dirt and swarf gathered up in machine operations must be removed. This can effectively be achieved by liquor solvent vapor trichlorethylene degreasing, by cold solvent naphtha washing, or by mild alkali cleansing, the first of these methods being preferred for convenience and efficiency. For chemical pretreatment, work is handled on racks, trays, wires or baskets according to its nature. It is immersed for the prescribed time and temperature, care being taken to avoid air-pockets and to expose all surfaces to the solution. Work in baskets should be shaken periodically. Thorough water rinsing through cold and hot waters follows, and then drying off by air blast or oven, or by the heat of the work itself. The articles are then ready for receiving the organic finishes in the normal way.

Typical phosphate processes are as follows: The Parker P. Z. process requires an immersion time of 5 to 10 minutes at 208 to 210 deg. F. The Bonderite D process as normally employed for iron and steel requires 3 to 10 minutes immersion at 175 to 185 deg. F. The Granodine process involves from 2 to 10 minutes immersion at 170 deg. F. The Granodine process for phosphatizing steel likewise may be used, 3 to 10 minutes at 175/185 deg. F. being entailed. All these processes yield results of similar order and all are satisfactory. It is especially to be noted that zinc alloys and steel work can be passed through the same plant when the latter exists already for rust proofing. Again, the spray Bonderizing and spray Granodizing processes for iron and steel may also be relied upon, but as these are generally designed for an exposure period of the order of one minute, which is effective for ferrous materials, they are not advocated because this short treatment is not considered adequate for maximum benefit.

All these proprietary processes are simple to maintain, cleanliness, controlled temperature and daily analysis with corresponding additions alone being required to keep them trouble free. Chemical consumption is very small, processing is rapid, and consequently production costs are insignificant. Entire elimination of finish-

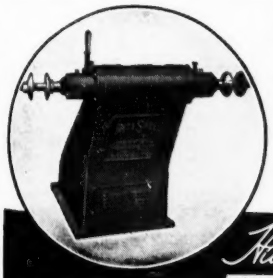

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TABLE No. 2
Performance of Enameled Zinc Alloy Die-Castings in Salt Spray Atmosphere

Sample No.	Constitution of Finish	Chemical Pretreatment	Performance Under Test
1	1 coat yellow chromate primer, stoved synthetic 1 coat green finishing enamel, stoved synthetic	None	No corrosion in 4 weeks but enamel embrittled and adhesion almost completely lost
2	Same as No. 1	Phosphate	In 4 weeks, a little corrosion at edges, otherwise appearance and adhesion unimpaired
3	Same as No. 1	Chromate	Unaffected in 4 weeks, adhesion unimpaired
4	1 coat red oxide primer, stoved synthetic 1 coat green finishing enamel, stoved synthetic	None	No corrosion in 4 weeks, enamel brittle and adhesion negligible
5	Same as No. 4	Phosphate	Practically unchanged visually in 4 weeks, adhesion unimpaired
6	Same as No. 4	Chromate	Unaffected in 4 weeks, adhesion unimpaired
7	1 coat aluminum, stoved synthetic 1 coat varnish, stoved synthetic	None	Adhesion deteriorating in 1 week, poor in 4 weeks; practically no corrosion
8	Same as No. 7	Phosphate	Corrosion along sharp edges in 4 weeks, but general surfaces and adhesion unaffected
9	Same as No. 7	Chromate	Unaffected in 4 weeks, appearance and adhesion unchanged
10	2 coats green cellulose enamel	None	Corrosion at edges in 1 week, much corrosion in 4 weeks, adhesion then very poor
11	Same as No. 10	Phosphate	No corrosion, cellulose hardened, but adhesion still good in 4 weeks
12	Same as No. 10	Chromate	Visually unaffected in 4 weeks, no corrosion, adhesion unimpaired but cellulose film harder
13	1 coat aluminum cellulose	None	Corrosion at edges, enamel softened and adhesion poor in 1 week
14	Same as No. 13	Phosphate	Corrosion at edges, otherwise unaffected in 4 weeks
15	Same as No. 13	Chromate	Slight corrosion at edges, otherwise unaffected and adhesion unimpaired in 4 weeks
16	1 coat cellulose/glyptal synthetic lacquer, air drying	None, but polished or shot blasted	Polished unaffected, shot blasted slight general corrosion in 4 weeks
17	2 coats green finishing enamel, stoved synthetic	None	White corrosion along edges in 4 days, much corrosion in 4 weeks, and adhesion of enamel very poor indeed
18	Same as No. 17	Phosphate	Virtually unaffected in 4 weeks, adhesion unchanged
19	Same as No. 17	Chromate	Unaffected in 4 weeks, adhesion unimpaired

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ing faults from lack of adhesion more than offsets the small additional expense.

Chromate finishes, some of them operated under license, give even better results than phosphate treatments, but they are rather more difficult to control which renders them less adaptable to general commercial needs. This can be appreciated from the following summary of an actual procedure in operation:

1. Vapor degrease in trichlorethylene to remove oils.
2. Immerse for 1-2 minutes in chromic acid (200 grams/liter) at 100 deg. C. and wash twice in cold running water. This step is intended to remove any tarnish or corrosion products, and may be omitted when the latter are not involved.
3. Cathodically clean (45 grams tri-sodium phosphate per liter) for 10-20 seconds, then wash in hot and cold running water.
4. Immerse in chromating solution (200 gms. sodium dichromate crystals, 9 ml. sulphuric acid/liter) for 5-15 seconds at 70-85 deg. F.
5. Rinse twice in cold running water until drippings show no perceptible yellow color. It is important that washings should not be carried appreciably beyond this point, but on the other hand a minimum washing is essential to remove all salts.
6. Dry quickly by compressed air, but not by oven heat.
7. Allow to age at room temperature for about 16 hours before enameling.

Actually, the chromate finish in itself definitely provides a good protective film over the casting apart from helping the paint or enamel to adhere, and to eliminate the peculiar softening that occurs with organic finishes on the untreated castings. On the other hand the actual process is rather delicate to operate with respect to immersion times and after washings. Thus, the castings must not be washed too well or allowed to dry too slowly, again an aging period is required before handling or finishing. Apart from this, the maintaining of the bath and methods of testing it are not so simple as for the phosphate methods.

The data presented in the accompanying tabulated forms demonstrate not only the relative merits of the chemical processes, but also the positive nature of their role in providing serviceability to organic coatings. These data are concisely summarized in self-explanatory form and the accelerated test conditions imposed are as under:

	Virtually unaffected in 4 weeks, adhesion unchanged	Unaffected in 4 weeks, adhesion unimpaired
Phosphate		
Chromate		

19	Same as No. 17	

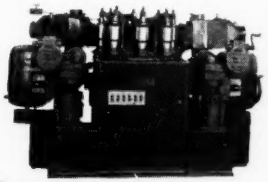

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TABLE No. 3
Performance of Enameled Zinc Alloy Die-Castings Under Open Weather Conditions

Sample No.	Constitution of Finish	Chemical Pretreatmen:	Performance Under Test
1	1 coat yellow chromate primer, stoved synthetic 1 coat green finishing enamel, stoved synthetic	None	No corrosion, adhesion lost in 4 weeks when enamel easily peeled by thumb nail
2	Same as No. 1	Phosphate	Entirely unaffected in 20 weeks
3	Same as No. 1	Chromate	Entirely unaffected in 20 weeks
4	1 coat red oxide primer, stoved synthetic 1 coat green finishing enamel, stoved synthetic	None	No corrosion, adhesion lost in 4 weeks, enamel easily peeled by thumb nail
5	Same as No. 4	Phosphate	Entirely unaffected in 20 weeks
6	Same as No. 4	Chromate	Entirely unaffected in 20 weeks
7	1 coat aluminum, stoved synthetic 1 coat varnish, stoved synthetic	None	No corrosion, adhesion very poor in 4 weeks
8	Same as No. 7	Phosphate	Entirely unaffected in 20 weeks
9	Same as No. 7	Chromate	Entirely unaffected in 20 weeks
10	2 coats green cellulose enamel	None	No corrosion, adhesion very bad in 3 weeks
11	Same as No. 10	Phosphate	Cellulose film hardened but no corrosion and adhesion good in 20 weeks
12	Same as No. 10	Chromate	Cellulose film hardened but no corrosion and adhesion good in 20 weeks
13	1 coat aluminum cellulose	None	Finished softened and adhesion poor in 3 to 4 weeks
14	Same as No. 13	Phosphate	Entirely unaffected in 20 weeks
15	Same as No. 13	Chromate	Entirely unaffected in 20 weeks
16	1 coat cellulose/glyptal synthetic lacquer, air drying	None, but polished or shot blasted	Entirely unaffected in 6 weeks, after which shot blasted specimens rapidly yellowed and became dirty in appearance
17	2 coats green finishing enamel, stoved synthetic	None	Adhesion lost in 3 to 4 weeks, enamel softened and easily peeled with thumb nail
18	Same as No. 17	Phosphate	Entirely unaffected in 20 weeks
19	Same as No. 17	Chromate	Entirely unaffected in 20 weeks

Table No. 1—Hot and Cold Humidity Conditions

The humidity conditions test is carried out in a closed cabinet in the base of which is a large tray of water. The temperature of the atmosphere within the cabinet is raised by means of electric heaters controlled by external rheostats, while a fan, suitably positioned, ensures uniformity of temperature and humidity. The test comprises suspension of the specimens in the upper half of the cabinet in which the temperature is controlled to 135 deg. to 140 deg. F. during the day with a humidity of approximately 70 per cent and allowing it to cool off during the night with a humidity rise to 100 per cent and condensation.

Table No. 2—Salt Spray Atmosphere

In this, specimens are subjected to the action of the mist produced by atomizing 20 per cent salt solution in a closed cabinet with clean, low pressure compressed air. The atomizer is operated during the working day of 8 hours, and the specimens left in the chamber overnight. They are examined daily after rinsing in flowing water and drying with a soft cloth.

Table No. 3—Open Weather Conditions

This merely comprises the exposure of samples freely suspended without protection in an open atmosphere.

A similar comprehensive range of finishes were examined under each set of test conditions, and like results obtained. In each table, it will be seen from samples Nos. 1 to 6 inclusive that the primers usually used successfully on ferrous work, chromate and red oxide pigmented types, on account of their inhibitive properties, offer no special merit in the case of the zinc alloys. Little difference is to be observed with the oven fired aluminum finishes, Nos. 7 to 9. Samples Nos. 10 to 15 illustrate the performance of cellulose finishes, which is closely similar to that of the baking synthetics. The failure of cellulose without pretreatment is not surprising, but the very good results obtained with one or two coats of cellulose over phosphatized or chromated surface is specially to be noted. Samples Nos. 17 to 19 demonstrate that likewise for the baked finishes there is no need for a special priming coat, these being directly comparable with Nos. 1 to 6. Sample No. 16 is of special interest insofar as it caters for a clear lacquer coating on castings that cannot be chemically treated, namely, polished or matted articles, and because it em-

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TABLE No. 4
Characteristics of Enamels, Primers, Etc., Employed for Tests

Material No.	Material	Class	Physical Characteristics		Chemical Characteristics		Drying Conditions
			Specific Gravity at 25 deg. C.	Viscosity at 25 deg. C. cps.	Volatile Spirit Per Cent	Total Solids Per Cent	
1	Yellow chromate primer, baking synthetic	Modified glyptal	1.120	200	58.5	41.5	Baking 30 min. at 250 deg. F.
2	Red oxide primer, baking synthetic	Modified glyptal	1.605	510	42.5	57.5	Baking 30 min. at 250 deg. F.
3	Green finishing enamel, baking synthetic	Modified glyptal	1.140	400	45.5	54.5	Baking 30 min. at 250 deg. F.
4	Aluminum baking synthetic	Modified glyptal	1.000	35	59.8	40.2	Baking 30 min. at 250 deg. F.
5	Varnish, baking synthetic	Modified glyptal	0.975	150	57.0	43.0	Baking 30 min. at 250 deg. F.
6	Green cellulose enamel	High consistency pigmented cellulose	1.110	1400	60.5	39.5	Air drying
7	Aluminum cellulose	Ready mixed cellulose	0.897	110	6.5	93.5	Air drying
8	Clear cellulose/glyptal lacquer	Low consistency cellulose synthetic	0.890	25	90.5	9.5	Air drying

ploys a low consistency cellulose lacquer of rather special formulation, and also because it does give good performance without undue softening or peeling of the coating.

Summarizing the durability test results very briefly, it can broadly be stated that with the exception of the special lacquer, all finishes applied without pretreatment rapidly deteriorated, not because of corrosion of the base metal, but because the finish itself changed, became soft and easily detached. All finishes applied to chemically pretreated castings gave excellent performance and entire confidence in their service behavior is established.

For the practical interest of finishing technicians, Table No. 4 gives a concise summary of the characteristics of all the finishing media employed. These enable an appreciation of the types covered by the tests to be better realized. Again, as the durability test results are not indi-

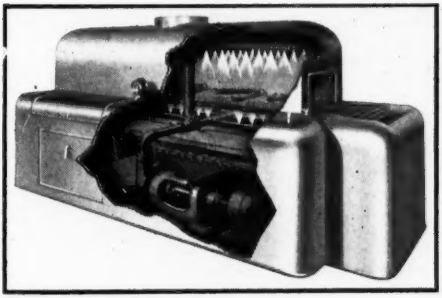
TABLE No. 5

Compositional Characteristics of Range of Zinc Alloy Compositions Covered by Tests

Composition Per Cent	No. 1	No. 2	No. 3	No. 4
Aluminum	4.05	4.25	3.95	4.30
Copper	nil	2.85	1.85	1.10
Magnesium	0.04	0.02	nil	0.03
Iron	0.05	0.04	0.07	0.04
Total other impurities, less than	0.005	0.005	0.005	0.005

vidual values, but represent average collected data, typical alloy compositions covered are included in Table No. 5.

Taking into consideration the time involved in developing the processes mentioned to their high degree of commercial reliability, and the wide field of testing that is entailed in covering all industrial finishes, it is obvious that an article of this type cannot be exhaustive. Nevertheless, it is felt that a comprehensive set of data has been set forth and discussed herein, from which most technicians can satisfy themselves with respect to their own needs. The organic finishing of zinc diecastings presents no inherent difficulties. However, no finish can be regarded as acceptable without having first applied chemical pretreatment. Its cost and production time are negligible. No special primers or undercoats are required, and the normal finishing enamels are suitable. Inexpensive finishes can be produced with single coats. High class finishes may need swarfing operations as a preliminary, or priming, filling and flatting may be resorted to. If clear finishes are essential, so that chemical pretreatment is taboo, then the special low consistency cellulose/synthetic combination should be sought. Finally, it is asserted that the chromate finishes are somewhat better than the phosphate ones, but the latter are more responsive to shop control, and are therefore advocated. The chromate finishes should be reserved for protection against damp storage for long periods, or for articles not destined to receive any additional finish.



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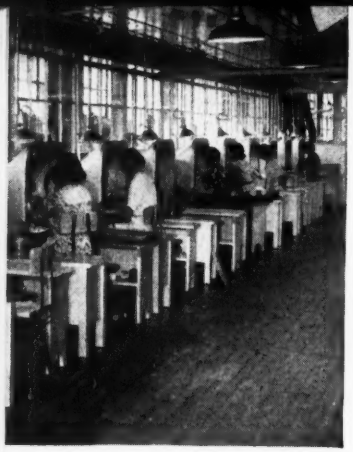

News OF THE INDUSTRY

Detroit A. E. S. Annual Educational Session

The annual educational session and banquet of the Detroit Branch of the American Electroplaters' Society will be held at the Hotel Statler, Detroit, Mich., Saturday, December 7th.

Among the speakers who will preside at the meeting will be the following:

Dr. C. F. Kettering—General Motors Research Laboratories

Dr. F. A. Rohrman—Michigan College of Mining & Technology

Mr. F. F. Oplinger—E. I. du Pont de Nemours & Company

Reservations for the banquet may be sent to Chas. R. Beaubien, 13919 Robson, Detroit.

Modern Plastics Exhibit Now Open

The chemist is easing us into a new age—an age that is full of wonders and magic. We are entering upon the Plastics Age, an era that is destined to bring the American high standard of living to an even higher level, a period that is bringing inexpensive but artistic luxuries to millions, giving comfort, adding conveniences and spreading contentment. The evolution of plastics has made possible the mass production of articles that were formerly denied to the masses because of price and lame production methods. This fact is concretely illustrated by nearly 1,000 entries in the Fifth Annual Modern Plastics Competition sponsored by "Modern Plastics" magazine. In fact, if ever there was anything to make you hold your breath, it is that exhibition room literally jam packed with all sorts of products, all made of plastic substances that were born in the chemists' test tubes.

The exhibition of the competition entries is open weekdays from 10:00 A. M. to 4:00 P. M. (except Saturday, when it will close at noon) and will close December 15th. There is no admission charge and all those interested in plastic applications are invited to view the pieces on display in Room 306, Chanin Bldg., 122 E. 42nd St., New York City.

The judges of the competition were: Alfred Auerbach, editor of "Retailing"; Harvey Wiley Corbett, prominent architect; William A. Kimbel, president of the American Institute of Decorators and of A. Kimbel & Son; Morris B. Sanders, architect and design engineer; A. N. Swigert, member of the Production Research Division Staff of the Chrysler Corp.; Harold Van Doren, industrial designer and author.

Miller to Head Ferro Liquid Plastics Division

The Ferro Enamel Corporation, 4150 E. 56th St., Cleveland, Ohio, through its president, Mr. Robert A. Weaver, has announced the appointment of Mr. L. H. Miller to head Ferro's Liquid Plastics Division. This division was recently formed to manufacture and market Vedoc organic finishes to the general industrial field.

Mr. Miller comes to Ferro from the Pittsburgh Plate Glass Company, Milwaukee, Wis., with which company he has been associated for the past several

years. Before joining Pittsburgh, Mr. Miller was in charge of the organic-finishing laboratories of Norge Division of Borg-Warner Corporation and prior to that he held a similar position with the Frigidaire Division of General Motors Corporation.

Manhattan Rubber Installs Tank Vulcanizing Equipment

One of the largest vulcanizers, measuring 15 feet in diameter and resembling a huge tunnel when open, has been installed at the factory of The Manhattan Rubber Mfg. Division, at Passaic, N. J., for vulcanizing rubber lined tanks and other equipment for their resistance against corrosive liquids and to prevent contamination to the processed substances.

Although for years Manhattan has been a leader in the rubber lining and rubber covering fields, this huge vulcanizer will enable the company to handle industrial equipment of greater magnitude for rubber lining of almost every description. In it can be accommodated practically any piece of equipment that can be shipped by rail, makinig it possible for Manhattan to keep well abreast with the modern requirements of industry for larger equipment.

Davis to Represent Tolhurst

Walter C. Davis will represent the Tolhurst Centrifugal Division and De-Bothezat Ventilating Equipment Division of American Machine and Metals, Inc., in Maryland, Virginia, and the District of Columbia, the company has announced. Mr. Davis, a graduate of the University of Tennessee School of Chemical Engineering, was formerly associated with DuPont and the General Chemical Company. He will make his headquarters in Baltimore.

Hogaboom Addresses Convention on Nickel Plating

During a recent convention of the National Stereotypers and Electrotypers Association at the Hotel Roosevelt, New York City, Mr. George B. Hogaboom, electroplating engineer of the Hanson-Van Winkle-Munning Co., addressed one of the sessions on the subject of nickel plating. Mr. Irving A. Gemmel, New York sales representative of the same company, also attended the meeting.

Goodell Delivers Paper on Radiant Heat

Paul H. Goodell, manager of Radiant Heat Division of C. M. Hall Lamp Company, 1035 E. Hancock Ave., Detroit, Mich., delivered an address entitled "Radiant Heat—A Full-Fledged Industrial Tool" before the AIEE Middle Eastern district meeting held in Cincinnati, Ohio, October 9-11.

The paper covered the principles and application of radiant heat in industry.

Gilbert L. Wolfe Appointed Representative of American Nickeloid Company

Mr. Gilbert L. Wolfe has been appointed representative of the American Nickeloid Company, 1320 Second St., Peru, Ill., to have charge of their Schenectady, N. Y., office and to cover central New York state for their pre-finished metals.

Mr. Wolfe has had considerable experience in production and sales work in the metal industry, having formerly been employed by Revere Copper and

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Brass Company, Rome, N. Y., and at New Bedford, Massachusetts.

Mr. Wolfe will present to manufacturers in that area the American Nickeloid line of pre-finished metals — finishes of chromium, nickel, copper or brass electro-bonded to base metals of steel, zinc, brass, copper, tin, or aluminum. Their products are available in sheets, strips, and in long continuous coils, as well as in interesting corrugated and striped patterns.

Government Officials Stress Necessity For Production Speed-Up

In addressing members of the Army Ordnance Association at its recent annual dinner in New York City, Robert P. Patterson, Assistant Secretary of War, Maj. Gen. C. M. Wesson, Chief of Ordnance, U. S. Army, and Wm. S. Knudsen, Production Chief, National Defense Advisory Commission, strongly emphasized the importance of metalworking plants speeding up their production schedules in connection with the National Defense Program, regardless of the outcome of the present world crisis.

As a member of the Army Ordnance Association, cooperating in its Industrial Mobilization Plan, Oakite Products, Inc., manufacturers of industrial cleaning materials, had as guests at the dinner, Erik Oberg, Editor, Machinery; Major L. D. Gardner, Institute of Aeronautical Sciences; C. B. Peck, Managing Editor, Railway Mechanical Engineer; Oscar Olsen, Grumman Aircraft Engineering Corp.; Ed. C. Mayer, Rickard & Company; Frank A. Page, Foster Wheeler Corp.; and D. X. Clarin; J. J. Beckett, V. D. Smith, C. F. Radley of Oakite Products, Inc.

C. C. Hermann Appointed Chief Engineer

C. C. Hermann has been appointed chief engineer of the Claude B. Schneible Co., 3951 W. Lawrence Ave., Chicago, Ill., designers and manufacturers of dust collection equipment, dewatering equipment, sludge pumps and vent hoods.

Mr. Hermann was in charge of the company's Philadelphia office as sales engineer since 1937. Previous to that he was connected with the engineering department of Deere & Co., Moline, Ill., for many years; and later was plant engineer of John Deere Tractor Co., Waterloo, Iowa.

C. C. Hermann

Mr. Hermann is a licensed mechanical engineer, a member of the U.C.C. of E., the A.F.A. and other engineering societies and groups and is well known to the engineering profession, having been a liberal contributor to engineering journals and to the trade press during the past 20 years.

Former I. T. & T. Engineer Joins Green Electric Co.

The W. Green Electric Co., Inc., 192 Broadway, New York City, announces the addition to its staff of Mr. L. W. Reinken, electrical engineer, formerly of the International Telephone Development Co., who recently returned to the United States after eight years abroad, where he had been engaged in supervising the promotion of Selenium Rectifiers in England, France, Belgium, Sweden, Denmark, Norway, Spain, Portugal, Hungary, Switzerland, Italy, and the Balkan nations. Mr. Reinken was one of the pioneers in the introduction of the Selenium Rectifier and his long experience has given him an unequalled first hand experience with this type equipment.

The International Telephone Development Co. recently introduced the Selenium Rectifier in the United States after ten years of successful experience in other countries and recalled Mr.

Reinken to utilize his experience for the American promotion.

The W. Green Electric Co., Inc., was the first organization in the United States to appreciate the unique advantage of Selenium Rectifiers for electroplating. Consequently, it developed a line of light, medium, and heavy duty rectifiers under the registered trade name, Selectro-Plater, incorporating the American made rectifier unit which uses the selenium stack. The Selectro-Plater has already gained wide acceptance as a source of low voltage current.

With the addition of Mr. Reinken to its staff, The W. Green Electric Co., Inc., is in a position to deal with any current supply problems in the electroplating field, from the smallest bench or laboratory unit to the largest industrial installations.

R. T. Barnes Delivers Addresses on Galvanic Corrosion

Galvanic corrosion will be discussed by R. T. Barnes, of the Development and Research Division of The International Nickel Company, Inc., 67 Wall St., New York City, in a series of talks he will give before various sections of the American Chemical Society on the West Coast during November.

In addition to explaining the theory of galvanic corrosion and illustrating the more common forms this type of corrosion may take, Mr. Barnes will speak on the consequences of such corrosion and will give a review of precautions necessary to minimize its effects. He will state that galvanic corrosion is controlled largely by three important factors: 1. the ratio of anode-cathode areas; 2. the resistance of the circuit; 3. the conductivity of the solution. In illustrating the first factor, the speaker will point out that it is much more dangerous to use a steel rivet in a copper plate than a copper rivet in a steel plate.

Mr. Barnes will also discuss briefly several of the important special forms of corrosion, such as dezincification, graphitic corrosion, corrosion fatigue, and season cracking of stress corrosion. He will illustrate his talks with slides. Mr. Barnes will appear before the Southern California Section in Los Angeles, Cal., on November 1st.

After attending Villanova College, Mr. Barnes received his degree as Bachelor of Science in Chemical Engineering from Massachusetts Institute of Technology in 1930. Before becoming associated with The International Nickel Company in developing corrosion resisting applications for nickel and nickel alloys, Mr. Barnes was employed as research chemist and development chemical engineer with the Fiberloid Corporation.

Du Pont Offers Restyled Identification Tag

As part of its established identification program, the Finishes Division of E. I. du Pont de Nemours & Co., Inc., is offering manufacturers a newly designed and restyled tag to identify the "Duco" pyroxylin lacquer finish on furniture and other articles.

Available in two types, flat or double-fold, this colorful tag gives quick pertinent facts about "Duco," including its wearing qualities and how it may be cleaned and maintained. Either style, as well as a related seal, may be obtained by manufacturers using approved "Duco" finishing systems.

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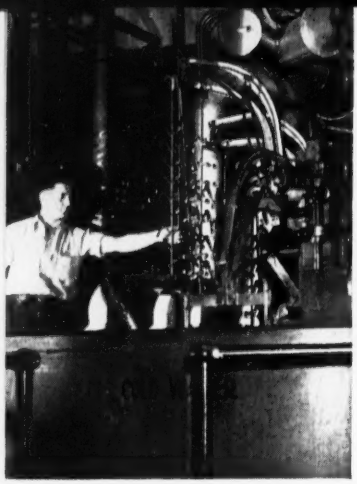
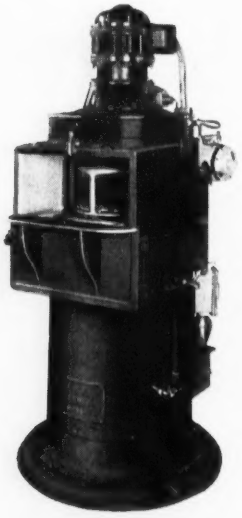


New PLANT EQUIPMENT AND Materials

Ronci Model R-200 Speedip Enameler

A speedip enameling machine designated as the Model R-200 has been placed on the market by Ronci Machine Company, 45 River Ave., Providence, R. I. Among the features of this unit are an automatic hydraulic tank lifting control, a basket capacity of 1,206 cu. in., and explosion proof motor and switch throughout.



Ronci Model R-200 Speedip Enameler

The Model R-200 speedip enameling unit is designed for lacquering or enameling metal or plastic parts. Coating of the work can be accomplished in as little as 60 seconds. All the work can be done in bulk, thus requiring no special handling. The unit is suitable for air dried or oven baked finishes.

Siefen Polisher's Brick

A polisher's brick which is recommended for removing oil or grease from wheels before they are reset with abrasive has been placed on the market by J. J. Siefen, 5657 Lauderdale Ave., Detroit, Mich. These bricks are available in the shape of a brick in the size of 2¼ by 4 by 8¼ inches.

The oil and grease absorption qualities of Siefen Polisher's Brick are said to make it ideal for cleaning wheels that are used for finish polishing or oiling in, on all grease or oil wheels, regardless of the material of which the wheels are made.

Chromalox Type MF Immersion Electric Heater

Edwin L. Wiegand Company, 7500 Thomas Blvd., Pittsburgh, Pa., has announced a new Chromalox Immersion Heater to be known as the Type MF. This heating element is designed for heating water and is said to embody improved design and operating efficien-

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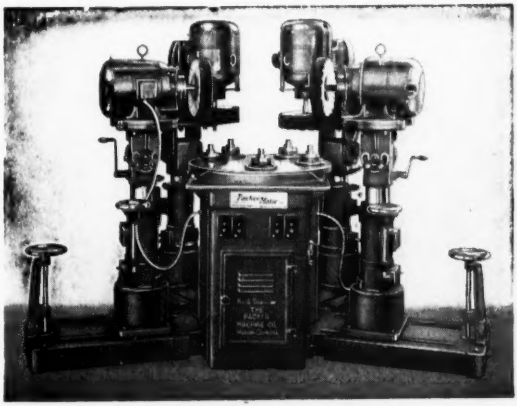

* Varied shapes and sizes of Parts both large and small are efficiently Polished and Buffed on Packer-Matic — Automatically — the modern way. Three types of Packer-Matic, Rotary (shown), Straight Line Conveyor and Roll, are proving their value, daily, in factories where volume Finishing is imperative.

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Chromalox Type MF Immersion Electric Heater

cy. The capacities of the Type MF range from 750 to 5,000 watts, inclusive.

The features of the Chromalox Type MF Immersion Heater include patented heating element construction for efficient heat transfer, long life, and the ability to withstand electric overload. The heater can be installed by bolting in place against a flat gasket seat which is furnished with the heater. If the tank or container is constructed of sheet metal, a companion flange or bushing can be used to hold the heater in place. The large, sturdy rectangular heating surface of the Type MF Immersion Heater is said to assure mechanical strength. A copper sheath is standard for water heating, although steel sheaths are also available.

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Herman Nelson Vertical Shaft Propeller-Fan Type hiJet Heater

A heating unit designed to provide a vertically-downward discharge of heated air for application where this type of discharge is desired has been placed on the market by The Herman Nelson Corporation, Moline, Ill. This heater, known as the Herman Nelson Vertical Shaft Propeller-Fan Type hiJet Heater, is available in two models.

The Model BMH for high ceiling location is said to provide high-outlet velocities. This model is available in three different outlet arrangements as follows: No. 1 will project a single column of air straight down; No. 2 projects two columns of air at angles of 30 degrees to vertical; and No. 3 arrangement projects the air at 30 degrees to vertical in all directions. Adjustment is provided to vary the outlet velocity 25 per cent from maximum.

The second type is known as the Model AMH and is designed with low outlet velocities for application where it is not necessary to suspend the heater at great distances from the floor. There are two discharge arrangements for this model as follows: No. 1 provides a louver which directs one-half the heated air in one direction and one-half in the opposite direction; arrangement No. 2 has a specially designed outlet for the diffusion of heated air.

The heating element is provided with expansion bends and a patented stay tube which is said to assure longer life. In addition, three distinct heating elements are available for each unit to

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NEILSON CHEMICAL CO.

6564 Benson St. Detroit, Mich.
1852 E. Slauson St. Los Angeles, Calif.

provide a sufficiently low outlet temperature at higher pressures. The fan is designed with wide face area and an

Herman Nelson Vertical Shaft Propeller-Fan Type hiJet Heater

aerodynamic or streamline shape which enables it to operate efficiently and quietly.

The Model AMH is available in six sizes providing from 43,000 B.T.U. to 193,000 B.T.U. with air deliveries from 545 to 2,620 c.f.m. This model is designed for mounting heights from 12 to 18 feet.

The Model BMH is manufactured in capacities ranging from 98,000 B.T.U. to 500,000 B.T.U. with air deliveries from 1,330 to 7,050 c.f.m. This model is designed for mounting heights of from 18 to 45 feet.

Taylor Remote Pneumatic Transmission System

A simple, accurate and in many instances the only practical and economical means of indicating, recording or controlling process variables remote from the point of measurement is offered by the new Taylor Remote Pneumatic Transmission System, manufactured by Taylor Instrument Companies, West Ave. and Ames St., Rochester, N. Y. This new system of remote transmission is particularly advantageous where it is desirable to correlate temperate, pressure, flow or liquid level data on a centralized panel or in a control room.

The system utilizes standard Taylor instruments. It may consist of one or two transmitters connected to a receiver; or one or more receiving instruments, not necessarily near each other, and as far as 1,000 ft. from the transmitter. Transmitters or receivers may be indicating, recording, or controlling types. Air pressure is the transmitting medium, with ¼ in. o. d. copper tubing as the means of connection.

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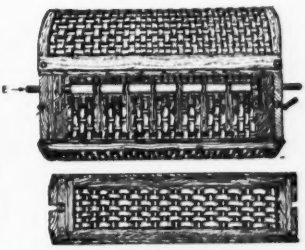

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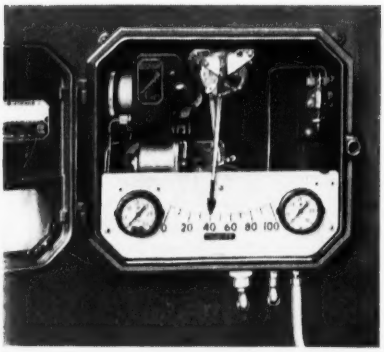
The Taylor Pneumatic Transmission System is highly accurate—well within ± one per cent of the scale range when



Taylor Pneumatic Transmission System

properly installed. The speed of response of the receiver to changes in output air pressure from the transmitter is largely dependent upon distance—the maximum lag being one second per 100 ft. of connecting tubing.

The new Taylor system eliminates the hazards of electrical transmission by doing away with electrical circuits in explosive atmospheres. It measures, transmits and receives continuously regardless of electrical current failures.

For the operator out on the unit, it provides an indicating or recording instrument for observation and eliminates the necessity of returning to the main control board to check the performance of the unit.

Industro Solvent No. 100

A non-inflammable solvent with great emulsifying properties, to be known as Industro Solvent No. 100, has been placed on the market by Industrial Chemical Products Co., 3777 Bellevue Ave., Detroit, Mich. This solvent can be used for cleaning automobile chassis, motors, automobile parts, and equipment of all kinds.

One part of Industro Solvent No. 100 can be diluted with from six to ten parts of kerosene or fuel oil. The diluted mixture can then be brushed, dipped, or sprayed on the parts to be cleaned. The parts can then be rinsed with either hot or cold water.

A diluted mixture of Industro Solvent No. 100 is said to emulsify all mineral oils, thus permitting them to be thoroughly removed by rinsing. According to the manufacturer, Industro Solvent No. 100 will not attack any metal.

Newark Safety Tran

The Newark Transformer Company, 17 Frelinghuysen Ave., Newark, N. J., has recently placed on the market a transformer primarily designed to reduce accidents that occur in handling electric extension cords in wet and damp places. The transformer has been designated as the "Safety Tran." This unit is a light, small cylindrical device, the outer shell of which is made of a non-corrosive, non-conductor, and tough compound shell enclosing an absolutely waterproof transformer element. The case is said to be water and moisture tight. A hook is provided on one end to carry and hang the unit where convenient.

In order to use the Safety Tran, it is merely necessary to plug one set of

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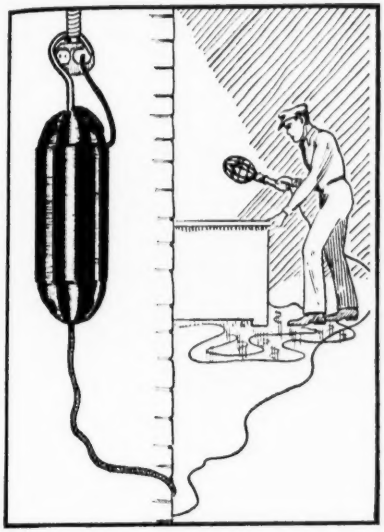
wires in any 110 or 115 volt receptacle, hanging the device by its hook on the BX receptacle or any other handy ob-



Newark Safety Tran

stacle or even permitting it to lie on its side on a table or floor. The light extension cord can then be attached to the other end of the transformer.

The function of the Safety Tran is to reduce any 110 or 115 volt current down to the safe six volts and thereby preventing shock, injury, or death to those working with an electric lamp in moist or damp places. A six volt lamp using up to 50 watts is also provided.

Hommel Kingbee Spray Gun

A new model "Kingbee" Spray Gun has been announced by The O. Hommel Company, 209 Fourth Ave., Pittsburgh, Pa. According to the manufacturer, this new model is especially suitable for spraying wide surfaces.

Besides a wider spray, allowing for greater efficiency, the new model is said to have a finer atomization and speedier distribution of material. The unit can be easily cleaned.

The Hommel Spray Gun is sturdily constructed and is designed to resist wear.

Willson Bantam Respirator

A light weight respirator, designated as the Willson Bantam Respirator, has been placed on the market by Willson Products, Inc., 271 Thorn St., Reading, Pa. This respirator is said to be the result of constant research and develop-

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ment by Willson engineers who have been working to meet industry's demand for protection without loss of working efficiency.

The Bantam is said to be so light in

Willson Bantam Respirator

weight and so easy to breath through that it can be worn for long periods of time without causing any noticeable discomfort or slowing down of the worker. From headband to exhaust valve, it is a completely rugged assembly. An all rubber face piece is designed to fit the contour of the face.

The Willson Bantam Respirator is designed to accommodate filtering mediums. Filter replacements can be made as frequently as necessary.

Carbon Brush Concaver

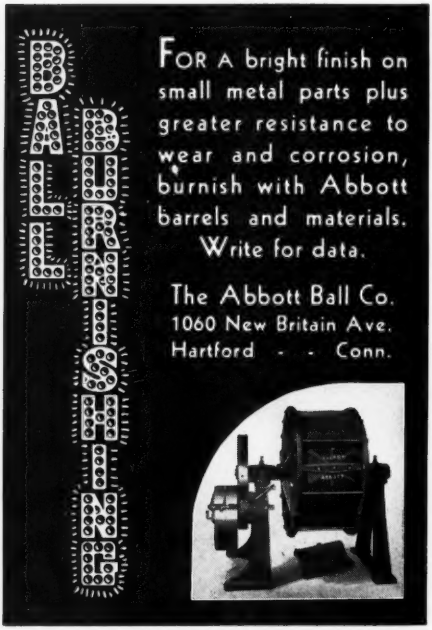
A device for correctly forming brushes to the Commutator Curvature, to be known as the "Carbon Brush Concaver," is now being marketed by the Ideal Commutator Dresser Co., 4004 Park Ave., Sycamore, Ill. An old brush can be used as a template to accurately locate the arc segment on the cutting guide slot. This arc corresponds to the contour of the commutator or slip ring. After this segment is found, the new brushes may be formed without further set up.

Any electric drill or electrical shaft drive can be used to operate the cutting head. The complete unit includes an aluminum guide casting, cutting file, removable angle plate with clamping device and "C" clamp. The Carbon Brush Concaver will accommodate practically any size brush used on 4 in. to 48 in. diameter commutator.

Truflo Pent House Fan

The Truflo Fan Company, 579 Main St., Harmony, Pa., announces a complete line of Pent House Fans for venting obnoxious gases, fumes, and dusts.

The pent houses are of sturdy steel construction and are available in a complete range of sizes for housing standard Truflo wall fans of 12 in. to 48 in. diameters. Sheet steel walls and shutters are mounted on heavy angle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Cleans, etches, and prepares metal for a perfect finishing job.
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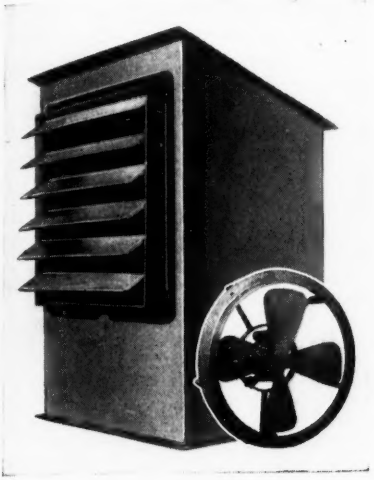
iron frame. The shutters open and close automatically, and the pent houses are designed to afford greatest possible protection against inclement weather conditions.



Truflo Pent House Fan with shutters open. Insert shows wall fan.

The pent house is placed directly over the opening through the roof of the building, and the fan exhausts the air up through the opening, or from several floors below by using a duct connected to the bottom of the fan housing.

Trabon Spray Nozzle

The Trabon Engineering Corporation, 1814 E. 40th St., Cleveland, Ohio, has announced a new type of spray nozzle for both low and high pressure service for spraying either water or oil.

This development is the result of several years research which has included service in various plants of one of the largest steel producers descaling hot steel, where it has proved its value in day in and day out service.

The "Trabon" Nozzle consists of only two parts—the header adapter is made of stainless steel and the nozzle which fits into it is accurately forged from a solid bar of Monel to the proper shape to give the maximum impinging force over a wide area.

The nozzles are manufactured with several sizes of orifices which are so designed that they effectually control the pattern of the spray, and the delivery is the same thickness at the sides as in the middle. The spray has no feather edges with corresponding reduced pressure. Except for a slight allowance for the extra distance the spray travels, the pressure at the edges of the spray is virtually the same as in the middle. These nozzles in the pressure headers of the descaling system assure the production of cleaner steel with fewer rejections.

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These HAMILTON products are used by W. R. Case & Sons Cutlery Company of Bradford, Pa., to glaze both sides of knives at the same time. TRY: "Indian Brand" Turkish and Naxos Emery or "Hecco Brand" American Emery. Write for your trial lot — today.

(Photo Courtesy W. R. Case & Sons Cutlery Co.)

HAMILTON Emery & Corundum Co.
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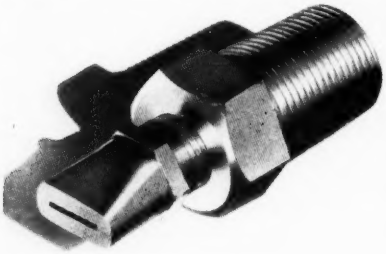
Other features include the use of the nozzles for cooling purposes, and for spraying a fine film of oil on finished



Trabon Spray Nozzle

stock to avoid corrosion while in transit or storage. There are many other practical applications for this new nozzle.

Recording Thermometers. A 40-page booklet describing a complete line of recording thermometers for every industrial use has just been issued by The Foxboro Company, Foxboro, Mass. The booklet is illustrated with more than 70 photographs of thermometers, their parts and accessories, and installation details. Principles and construction of the new Monotherm system incorporated in all Foxboro recording thermometers are explained in detail.

The four classes of recording thermometers discussed are: vapor pressure; gas pressure; liquid expansion with bimetal coil compensation; and liquid expansion with twin-unit compensation. Characteristics of thermometers of each type are given, including response, accuracy, temperature limits and thermal system of the instrument. Detailed specifications of standard bulbs for each group are also included.

Both the long distance and self-contained type recorders are covered in the bulletin; also multiple pen recording thermometers. Special units equipped with removable elements, a particular advantage to multiple pen instruments, are shown.

Several methods of installation each are shown for kettles, cookers or retorts; pipe lines; rooms, dryers and ovens; and tanks and vats. Illustrations explain graphically how each installation is made; in addition, the advantages of each method are discussed for particular applications.

A final section covers related instruments, such as electric resistance thermometers, pyrometers, humidity recorders and controllers, temperature controllers and indicating thermometers. For copies of this bulletin, No. 198-2, write to The Foxboro Company, Foxboro, Massachusetts.

Metal Working and Finishing Performance Data. A 48-page bulletin for the metal working and finishing industry is now being issued by Magnus Chemical Company, Inc., 10 South Ave., Garwood, N. J., manufacturers of industrial cleaning materials and metal working lubricants. The bulletin consists of a series of detailed performance reports from metal working plants of all kinds, outlining improvements and economies effected by the use of properly selected cleaning materials in comparison with formerly used materials and methods.

For convenience, these reports are arranged in a number of classifications, each involving a particular metal clean-

ing and finishing operation.

The reports are full of usable and practical ideas that will help you save money, speed production and meet rigid quality specifications.

Copy free upon request.

Magnus Skin-Gard. The Magnus Chemical Company, Inc., is now issuing a descriptive, illustrated folder on its product, Magnus Skin-Gard.

Magnus Skin-Gard is a cream which, when rubbed into the skin, protects it against chemicals, solvents, and dirt of all kinds—against dangerous infection, annoying cracks and abrasions. Workers whose skin comes in contact with solvents find Skin-Gard beneficial in preventing the solvents from removing the natural oils in the skin.

Magnus Skin-Gard comes in two grades; regular and waterproof. Waterproof Skin-Gard effectively protects the skin against water, acid and alkaline solutions.

The folder also discusses in detail the classifications and cause of industrial dermatitis and its prevention.

A copy of the Skin-Gard folder can be obtained by writing to the Magnus Chemical Company, Inc., 10 South Ave., Garwood, New Jersey.

Automatic Temperature Control in Electroplating Processes. A fully illustrated folder describing automatic temperature control instruments for electroplating processes is now being issued by the Foxboro Company, Foxboro, Mass. The Foxboro Duplex automatic temperature control instrument described in this bulletin combines within one case two separate and complete control mechanisms. One of these operates the controlled valve in the steam line and the other operates the cold water supply valve. When the bath temperature reaches the high point or the low point for which control has been set, the proper valve is opened, to cool or to heat the bath as may be required to maintain it at its proper temperature. Because the temperature measuring system is of the vapor pressure type, the most quickly responsive of all types, control action is immediate and wide variations in bath temperature cannot occur.

A pair of index pointers, positioned by a convenient setting device, indicates on the chart the high point and the low point at which the two controlled valves are to operate. A micrometer screw permits the adjustment of the pointer spacing so that the temperature difference between high and low may be less than one per cent of the the chart range.

The Foxboro Duplex controller is a sturdy industrial instrument, designed and built for industrial conditions. Its gasketed die-cast case closes securely against dust, moisture, and vapors. It is

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"Light Where You Want It—Plus Protection," is the subject of a 4-page catalog, just released by The Boyer Campbell Company, 6540 Antoine St., Detroit, Michigan.

This catalog features the universal adaptation of Marvel Shields to industrial operations and illustrates installations on stationary grinders, disc sanders, surface grinders, band filers, shapers, metal band saws, milling machines, universal tool and cutter grinders, mortising saws, lathes, and so on. Marvel Shields are supplied either with a plain shatter-proof or magnifying lens, framed with a macerated resin plastic material that is strong and sturdy and a natural insulator of electricity.

A supplementary folder, titled "Super Sight," describes this same principle of light properly directed, plus magnification adapted to first aid and hospital use.

This company has specialized in safety equipment for more than 20 years and also has available for distribution a 144-page catalog which includes safety tongs, vacuum lifters, sheet metal lifting hooks, punch press guards, ejectors, gloves, safety clothing, and so on.

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Flexrock Handbook. A handbook of building maintenance is now being issued by Flexrock Company, 23rd and Manning St., Philadelphia, Pa. This handbook includes innumerable new phases of building maintenance. How to spontaneously stop leaks, make feather-edge patches "stick" to concrete, how to patch roofs economically, how to install floor grids, and hundreds of other educational suggestions are included in its 74 pages and over 150 illustrations. Copy free upon request.

Despatch Ovens. An attractive, informative, and pictorial bulletin designated as the No. 51 and describing Despatch Finish Baking and Drying Ovens for synthetic enamels, lacquers, varnishes, paints, enamels, and japans is now being issued by Despatch Oven Com-

pany, 622 S. E. Ninth St., Minneapolis, Minn. There are ideas galore about new finish baking and drying ovens, also helpful suggestions on modernizing present equipment. A copy of Bulletin No. 51 will be sent free upon request.

Pneumix Agitators. The Eclipse Air Brush Company, 390 Park Ave., Newark, N. J., has just issued a four-page, 8 by 11 in. folder showing the various types and sizes available in its line of Pneumix air-motored agitators. These mixers are important because of their explosion-proof, splash-proof performance, and because variable speeds from 30 to 6,000 r.p.m. are obtainable with them. The folder will be sent free upon request.

Grinding Wheel Data Book. The fourth revised edition of the Abrasive Company Grinding Wheel Data Book is now being issued by Abrasive Company, Tacony and Fraley Sts., Philadelphia, Pa. This data book contains complete descriptive information regarding the manufacture, use and application of grinding wheels. It also includes general recommendation tables and tables showing standard sizes and shapes.

American Data Sheet No. 241. An automatic air filter unit now being manufactured by American Air Filter Company, Inc., 702 Central Ave., Louisville, Ky., is described in a bulletin designated as Data Sheet No. 241. The casing of the new unit has been designed in such a way that either Armored screen panels or die-stamped louver panels can be used for the filter curtain.

A copy of this bulletin will be sent free upon request.

Standard Bulletin No. 38-A. An infinitely variable speed buffing and polishing machine, recently developed by the Standard Electrical Tool Company, 1941 W. Eighth Street, Cincinnati, Ohio, is fully illustrated and described in Bulletin No. 38-A, now available for distribution. A speed changer making it possible to secure any spindle speed from 1,000 to 3,500 r.p.m. by merely turning a handwheel is incorporated in the machine.

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This Opportunity Section is available for classified advertisements featuring equipment, employment, business opportunities, etc., in the industries devoted to the cleaning, plating, polishing and finishing of metals. For advertising rates and other information address:

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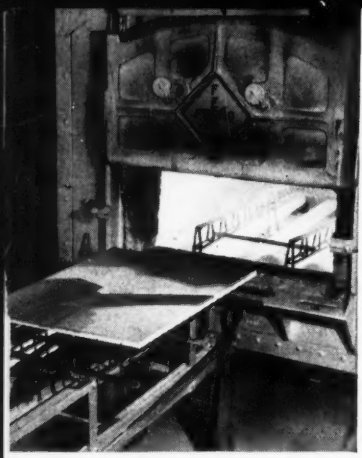

FOR YOUR *Catalog* LIBRARY

To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. Heatbath Metal Treating Chemicals

A beautifully illustrated catalog describing Pentrate finishes for steel products is now being issued by Heatbath Corporation, Springfield, Massachusetts.

2. Griptite Metal Cement

Literature describing a rubber cement for bonding rubber, felt, cardboard, and so on, to metal is now being distributed by St. Louis Rubber Cement Co., 3952 W. Pine Blvd., St. Louis, Missouri.

3. Globe Finishing and Tumbling Barrels

One of the most completely illustrated catalogs on finishing and tumbling barrels for metal parts is now being issued by The Globe Machine & Stamping Company, 1250 W. 76th St., Cleveland, Ohio.

4. Dust Control

A complete story of dust control in words and pictures by means of Roto-Clone dust control equipment is now being issued by American Air Filter Company, Inc., 702 Central Ave., Louisville, Ky.

5. Airway Ventilated Buffs

Cool cutting buffs for high speed buffing operations are illustrated and described in a 4-page folder now being distributed by Jackson Buff Corporation, 21-03 41st Ave., Long Island City, New York.

6. Grinding Wheel Data Book

A 112-page catalog containing complete descriptive information about the manufacture, use and application of grinding wheels is now being issued by Abrasive Company, Tacony and Fraley St., Philadelphia, Pennsylvania.

7. Salts of the Platinum Metals and Gold

A beautifully illustrated 12-page catalog containing complete tables of information on platinum metals and gold is now being issued by Baker & Co., Inc., 113 Astor St., Newark, New Jersey.

8. Orvus for Alkaline Cleaning Baths

All those engaged in metal cleaning operations will be interested in information regarding an alkaline cleaning bath addition agent known as Orvus now being distributed by Procter & Gamble Co., Gwynne Bldg., Cincinnati, Ohio.

9. Analysis of Plating Solutions

The fifth edition of this booklet describing simple methods of analyzing plating solutions is now being issued by Hanson-Van Winkle - Munning Co., Matawan, New Jersey.

10. Seamless Rubber Lined Equipment

Information on the rubber coating of dipping baskets, pitchers and dippers, and tanks of all kinds is contained in folders which are now being issued by Paramount Rubber Service, Inc., 1430 Rosedale Ct., Detroit, Michigan.

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11. Industrial Ovens

An illustrated industrial oven book featuring safety, speed, economy, and efficiency in industrial drying and finishing processes is now being issued by The Kirk & Blum Mfg. Co., 2816 Spring Grove Ave., Cincinnati, Ohio.

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12. Despatch Finish Baking and Drying Ovens

A very complete 12-page catalog covering Despatch Finish Baking and Drying Ovens for synthetic enamels, lacquers, varnishes, paints, enamels, and japans is now being issued by Despatch Oven Company, 622 S. E. Ninth St., Minneapolis, Minnesota.

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13. Chemical Resisting Equipment

Chemical resisting equipment for electroplating and metal pickling process is described in a folder which is now being issued by Heil and Company, 3088 W. 106th St., Cleveland, Ohio.

14. New Wrinkles in Finishing

Vol. 2, No. 4 of a very interesting catalog showing applications of New Wrinkle finishes is now being issued by New Wrinkle, Inc., Mutual Home Bldg., Dayton, Ohio.

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15. Metal Cleaning Tips

The chemical classification and selection of alkaline metal cleaners is contained in a bulletin which has been prepared and is now being distributed by the Cowles Detergent Company, 10525 Carnegie Ave., Cleveland, Ohio.

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16. Paper Masking Tape

A masking tape that is highly resistant to lacquers, paints, and solvents is described in this folder now being issued by Industrial Tape Corporation, New Brunswick, New Jersey.

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17. Rust Prevention for Iron and Steel

A description of Parkerizing, what it does, and how it is applied is contained in a book entitled "Parkerizing" now being issued by Parker Rust Proof Company, 2172 E. Milwaukee Ave., Detroit, Michigan.

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18. Weka Grinding and Polishing Wheels

A six-page folder describing and illustrating Weka grinding and polishing wheels is now being issued by Atlantic Weka Corp., 35 Wooster St., New York City.

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